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TEACHING SPECIALIZATION AS A STRUCTURAL PROPERTY

OF ALBERTA SCHOOL SYSTEMS

by

 WILLIAM BERNARD TYLER

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF MASTER OF EDUCATION

DEPARTMENT OF EDUCATIONAL FOUNDATIONS

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "Teaching Specialization as a Structural Property of Alberta School Systems" submitted by William Bernard Tyler in partial fulfilment of the requirements for the degree of Master of Education.

ABSTRACT

The increasing specialization of teaching personnel, though a significant development in educational organization, has not yet been empirically isolated as a structural dimension of school systems. This investigation which set out to isolate and measure this property may be seen as an extension of recent work carried out in the scaling of organizational variables as well as a contribution to the development of an empirical taxonomy of school systems. A specialism was operationally defined as an activity added to a school system as a function of the historical diversification of curricula and services rather than as a function of the internal differentiation of tasks.

Data on the possession of ten specialisms were collected from ninety-nine school districts over the period 1965-8. These data were scaled by the Guttman technique to test whether or not they represented a single cumulative variable. Coefficients of reproducibility ranging from .85 to .94 on groupings of observations based on type of formal constitution, size and year of observation indicated that specialization as defined represented a strong and reliable unidimensional property. Counties and school divisions were found to follow the same scaling pattern, while large and small city districts had different orders of item occurrence. A different pattern was found for public and separate districts where, instead of one ten-item scale, two five-item scales emerged.

In order to investigate the relative predictive effects of size (number of teachers) and history (year of observation) on this newly derived variable, a multiple regression equation was set up. Including only those groupings that were measurable by a ten-item scale (i.e. counties, divisions and city districts), it was found that the effect of adding year of observation to the model made a slight, though significant improvement in prediction. Taking only one observation at random for each of the remaining seventy-six systems, and thus ignoring the very small effect of history, it was found that size correlated highly with specialization (+ .60).

These findings open up possibilities for the intensive exploration of the contextual determinants underlying the scaling pattern that was discovered and for the extension of the technique used here to the isolation and measurement of other structural properties of educational organization.

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In particular, I wish to express my gratitude to Professor D.J. Hickson of the Organizational Behavior Research Unit for kindly consenting to sit on the examining committee a few days before his departure for England.

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CHAPTER I

INTRODUCTION

The diversification of programs at the high school level, together with an increased demand for specialist services has led in the past two decades to a rise in the proportion of teachers trained and hired especially for the performance of duties that were once the sole province of the regular class-room teacher. The phenomenon is described by Burton R. Clark:

> With educational work becoming more varied and complex, the school or college does not escape the growing specialization found elsewhere in modern social organization, but rather becomes more of a system for coordinating a growing array of unlike specialities. Expanding knowledge militates sharply against efforts to maintain educational work in an undifferentiated state. Academic disciplines proliferate, and professors specialize in and within disciplines, fragmenting the campus and deepening the problems of communication and coordination. The teacher in elementary and secondary school is less affected by the intense specialization that occurs along the edges of advanced knowledge, but he also moves toward specialization in subject matter and grade level. The teacher who could handle all subjects for six to eight grades in the small school house has been rendered incompetent, and the changes underway in the 1960's in the curriculum of the elementary school (e.g. foreign language instruction, new mathematical and scientific materials) accelerate the trend toward specialization that has replaced the old schoolmarm with teachers who possess a particular strength and prefer to handle only a small part of the subject matter.[1]

Within Alberta, this trend is illustrated by the addition, since 1950, of at least three major routes to the B.Ed. program,[2] by the institution, in the post-war period, of specialist certification in twelve teaching areas,[3] by the appointment of four new specialist supervisors at the provincial level[4] and by the burgeoning of specialist councils of the Alberta Teachers' Association, since 1960 alone, in twelve areas.[5] A glance at the advertised positions of employing

authorities is also revealing of the specificity of qualifications required.[6]

However obvious, let alone significant, this development may be,teaching specialization has not yet been isolated in any previous research as a property of the network of formal relationships that constitute the structure of schools or of school systems. This is not suprising, since occupational specialization has not been isolated empirically as a structural property of any other type of organization to date. In order to isolate, measure and compare specialization as a structural property of school organization, it would be necessary to treat the organization itself as the unit of analysis and after first establishing the logical homogeneity of a defined set of teaching positions, to demonstrate their statistical consistency from their distribution among the particular population of organizations chosen. In this latter connection, it would be of greatest advantage if it were shown that teaching positions within this set were not only internally consistent, but distributed in such a manner that they could be ordered in the form of a scale, indicating that they represent different aspects of a single variable. The advantage would first be theoretical, in that the set would then have the status of an empirically-based, independent dimension of organizational structure. Secondly, there would be a practical advantage in that prediction of the order in which new specialisms will be added, in the case of a particular organization, is implied in the unidimensional pattern.

An investigation of the relationship between specialization and other organizational characteristics would be possible once the isolation and measurement of this property are resolved. Two particular predictors, easily quantifiable and theoretically interesting, are those of size and history. By taking these together, it would be possible to find out whether specialization in Alberta school systems is increasing with time alone, or whether it is a function of organizational growth. On the basis of this analysis, it would be possible to set up regression equations with size and year of observation as

predictors and specialization as the criterion--an exercise which would have certainly a theoretical, and perhaps a practical, value.

The problem then, has two aspects:

1. Can it be shown empirically that teaching specialization constitutes a structural dimension of Alberta school systems?

2. If a dimension can be isolated and measured, what is the effect of knowing system size and year of observation on predicting a specialization score?

In the following chapter, the theoretical background to specialization both in terms of organizational theory generally and in the educational area specifically is presented. This chapter will also outline the theory behind any possible relationships between specialization, size and history. The third chapter will deal with the operational definition of specialization and with the sampling procedures employed in this study. In chapters 4 and 5 we will deal with scaling (Problem 1 above), the former with theory and hypotheses and the latter with a presentation and discussion of results. Chapter 6 will present the statistical techniques, hypotheses and results associated with the exploration of the correlates of specialization (Problem 2 above). A concluding chapter will summarize the findings and suggest directions for further research.

FOOTNOTES: CHAPTER I

1. Burton R. Clark, "Sociology of Education", in Handbook of Modern Sociology, ed. by Robert E. Farris (Chicago: Rand McNally & Co., 1965), p. 758.

2. "Faculty of Education", University of Alberta Calendar, 1949-50 through 1969-70 (Edmonton: University of Alberta Printing Services). These are special education, vocational education and fine arts; not taken into account are the "minor" specialist routes such as guidance or librarianship, nor the considerable expansion within major routes over the past two decades.

3. Alberta Department of Education, Regulations Governing the Certification of Teachers, Effective May 17, 1954 (Edmonton: Queen's Printer, 1954), p. 6. Areas were: Art, Dramatics, Music, Bookkeeping, Stenography, Typewriting, Commercial Subjects, Industrial Arts, Unit Shop, Home Economics, Physical Education, Guidance. Specialist certification has since been abandoned; for reasons see John W. Chalmers, Schools of the Foothills Province: the Story of Public Education in Alberta (Toronto: University of Toronto Press for the Alberta Teachers' Association, 1967), p. 198.

4. Alberta Department of Education, Annual Report, 1968 (Edmonton: Queen's Printer, 1968).

5. John W. Chalmers, Teachers of the Foothills Province: The Story of the Alberta Teachers' Association (Toronto: University of Toronto Press for the A.T.A., 1968), p. 245. The councils cited are organized in the areas of: English, Mathematics, Social Studies, Home Economics, Business Education, Industrial Arts and Vocational Education, Health and Physical Education, Fine Arts, School Library and Early Childhood Education.

6. Listings are almost invariably in terms of program area (home economics, vocational education), subject area (biology, Oral French), specialist service (guidance counselling, librarianship) or grade level (elementary and primary positions).

CHAPTER II

THE THEORETICAL BACKGROUND

A. SPECIALIZATION

The study of specialization requires first a conceptual framework that will make the examination of its measurement and correlates relevant to a broader organizational context. After a discussion of the status of specialization both in general organizational theory and in the sociology of school systems, the relationship that size and history may have with this property will be delineated.

The concept of bureaucracy, besides being of fundamental importance to writings on organizational structure,[1] has most frequently provided the framework for the consideration of specialization as a structural property.[2] It may serve therefore as a point of general orientation. This concept, however, has been traditionally defined over a spectrum of analytic levels, causing a confusion which has impeded the identification and measurement of its empirical manifestations. Weber's description of the ideal bureaucratic type specified several different orders of analysis--the structural (formalization, hierarchy, specialization), the behavioral (objectivity, formalism, precision) and the functional (modes of appointment, promotion and remuneration).[3] As pointed out by Pugh et al., later theorists have tended to regard the ideal type as a 'unitary concept' and consequently criticized it in global terms or rejected it in toto.[4] As a result, very little progress has been made toward the theoretical explication of the levels of analysis implied in the type--a preliminary to the empirical examination of the inter-relationships postulated between properties at any particular level.

Some of first empirical studies of Weber's ideal type in the structural domain were carried out by Richard Hall who worked from subjective data designed to investigate the distribution of six major

characteristics.[5] Although the correspondence between Hall's data and the objective distribution of these same characteristics may be questioned,[6] a major theoretical contribution was made by the postulation of the multidimensionality of the bureaucratic type, at least in the realm of structure.

Studies in the same area using non-subjective data were carried out by Blau et al. who examined the relationships between the division of labor and the configurations of hierarchy among a group of small public service bureaucracies.[7] The measures used in this study, however, were ratio and interval scales that made questionable assumptions as to the scalability of raw numerical data. The pioneering work in the exhaustive validation of the Weberian ideal bureaucratic type, based not only on non-subjective but also empirically scalable data was carried out by a group of British researchers in what are known as the 'Aston' studies.[8] These constituted a major advance in both methodology and theory, since it was found possible, on the basis of statistically valid scales, to derive an empirical taxonomy of organizational structure, demonstrating in precise terms the multidimensionality of the Weberian type.

Theory and research on complex organization in education has been concerned more with administrative behavior than with the development of an empirical theory of organizational settings. Studies have focused on attitudes and expectations associated with supervisory role[9] and leadership,[10] and have therefore relied heavily on perceptual data. Those studies that have dealt with dimensions of structure have also dealt more with perception of role incumbents than with 'objective' data, following the example of Hall and in some cases, using his instruments.[11] Where non-subjective data has been used in the structural area, it has chiefly been to document the relationship between organizational size and administrative ratio.[12] Very little advance has been made, therefore towards Corwin's proposed empirically-based typology for describing school organizations by a systematic comparison for their 'elementary properties' of structure.[13]

Corwin's complaint that 'the study of complex educational organization is a neglected topic', [14] echoing a similar statement made by Bidwell that 'few students of organizations have turned their attention to schools and few students of schools have been sensitive to their organizational attributes'[15] suggests that an attempt should be made to direct research towards a general conception of educational organization. Although both writers indicate an interest in structure either in terms of the problems of 'co-ordination and allocation'[16] (Corwin) or 'the distinctive combination of bureaucracy and structural looseness'[17] that typifies educational organization (Bidwell), Corwin alone goes on to propose a general theoretical framework for the empirical description of these areas where administrative problems originate. These he defines as 'the internal principles or organization, the complex system of authority and the division of labor'.[18] Since it is this latter aspect--the division of labor--that was chosen for study, it would be profitable to place it first in a theoretical, and then in an educational, context.

The division of labor has long been considered characteristic of the bureaucratic type of organization. Weber cites it as one of the prime features of his ideal type[19] and as a constant theme in organizational literature it is difficult to ignore.[20] Hickson has pointed out that the concept of 'specificity of role prescription' has been a pervasive though unrecognized point of 'convergence' in organizational theory.[21] In this connection, specialization, or the specificity with which tasks are designated to occupations, is an important aspect of bureaucratic structure. The concept has been refined by Friedmann who makes the distinction between 'the specialist' and 'the specialized'. Whereas the latter term is a function of the narrowness of tasks assigned to a particular role, the former implies a breadth of knowledge about a whole industry or profession, in addition to expertise.[22] The importance of this refinement for a profession such as teaching is obvious.

The relationship between specialization and other structural aspects, particularly the distribution of power, has been the subject of a good deal of theorizing. This relationship has seldom, however, been the subject of empirical investigation for which a measurement of specialization may have been developed. Hage and Aiken, in a study of agricultural organizations, found that participation in decision-making was positively correlated with the number of occupational specialisms, and with professional activity,[23] while Blau et al., whose findings suggest 'that centralized authority is well suited for the coordination of tasks differentiated into simple routines, but not for professional specialties', used a similar measure.[24] The Aston researchers, owing perhaps to the cross-sectional nature of their sample, limited their definition of specialization to 'functional' or non-workflow activities such as 'maintenance', 'public relations', 'transport'.[25] Since such a definition neglects workflow specialization that may occur among say assembly-line workers, store clerks or teaching personnel, it necessarily restricts the measurement of the overall division of labor. Specialization as defined was found to be associated strongly with 'standardization' and 'formalization'.[26] A study of educational specialization at the national level was carried out by Joseph P. Farrell who used Guttman Scalogram Analysis to explore the sequences of evolutionary differentiation of nineteen school systems in Latin America. The thirteen categories chosen by Farrell were, however, extremely heterogeneous: seven dealt with workflow or teaching activities ('secondary industrial school', 'special education school') while six were of either a hierarchical or a 'functional' origin ('ministry', 'teacher training institution', 'national planning agency'). This heterogeneity would indicate that it was the process of differentiation that was the subject of inquiry rather than the isolation and measurement of a theoretically concordant dimension of structure.[27] It must be pointed out, in conclusion, that important as these empirical studies may be, they are deficient in one or other of the following ways: either the raw score for the number of operationally defined categories was used without prior tests for

internal consistency or scalability, or the definition was not constructed to measure those activities of workflow that are preculiar to each type of organization.

Specialization considered here as an organizational characteristic, or the division of labor,among teaching personnel has not so far been the subject of empirical research, though Bidwell recognizes it as a mark of the bureaucratic nature of educational organizations,[28] and Corwin gives it priority as an 'elementary property' of structure.[29]

Corwin's elaboration of the phenomenon in school systems is valuable and will serve as a guide to the development of an operational definition in the next chapter:

> THE DIVISION OF LABOR. The way work is divided and allocated determines the number of divisions at each level of the organization. The number of separate educational 'track' systems (e.g. vocational, college prep, and general programs) and the number of separate academic departments and special administrative units are indices of the extent of the division of labor in schools.[30]

Two objections to Corwin's definition must be made at this point--to the unit of analysis chosen and the heterogeneity of his sample of specialisms.

In the first instance, though Corwin focuses his attention on 'schools' as the unit of analysis for his proposed typology of educational organization, it should be asked whether this is justified, at least in the case of the division of labor. Although, admittedly, the school is the locus of operation of specialisms, it is only through the processes at the board or district level--the allocation of resources to meet organizational goals--that the presence of a specialism at a local level can be fully comprehended or explained. In the school systems of Alberta, for example, decisions as to the hiring and placement of staff are not the province of the school principal, but of the superintendent acting as executive for a school board or committee.[31] The choice of the unit of analysis is a theoretical question, therefore, in this instance best resolved by taking that level where decisions as

to the disposition of resources are made--the school board.

The second objection is illustrated in the heterogeneity of the 'divisions at any one level' that Corwin cites--'tracks', 'academic departments', and 'administrative units'. Although these are indeed examples of the division of labor, it is clear that the vocational wing in which there are perhaps ten large subject areas does not represent the same type of specialization as one academic department such as French. The distinction between these two manifestations of the division of labor lie in a consideration of the growth of school systems. While the 'track' or administrative unit is more likely to have been added through the diversification of program area, the academic department has arisen from a differentiation within an already existing area, as a function of size rather than of adaptation to community pressures for more and varied educational offerings.

A theoretical basis for this empirical distinction which may serve to justify the homogeneity of a set of specialisms is to be found in the models of innovation formulated by Terry N. Clark. Although proposed for institutions of higher education, they have a relevance to all educational systems. Two of these models in particular--the'organic growth model' and the 'differentiation model' --deserve consideration.[32] While the former is 'most applicable to innovations that develop outside of established institutional structures',[33] the latter 'seems particularly applicable to innovations that are institutionalized largely within existing academic structures'.[34] Since the addition of a novel 'track' or administrative unit would be more likely to be the result of pressures originating outside the school system (a good example is to be found in the history of vocational education in Alberta)[35] than would be the setting up of a new department in an already established area, a consistent application of either the 'organic growth' or the 'differentiation' model would be useful as a basis for an operational definition that achieves a theoretical homogeneity of content.

What might be the use of a measure derived from an 'organic growth' model, should it be possible to show that a set of teaching specialisms were distributed as a single variable? Even though the process of 'adding on' a specialism does not increase the specialization of other activities, as occurs when work is divided by a process of differentiation, it nevertheless has important implications. By adding an extra program or subject area, the school system becomes more complex. At the school level, formal changes in time-tabling and course programming will occur; adjustments in the allocation of money for texts and equipment will be made, perhaps accompanied by conflict as the new area struggles for recognition. At a higher level, the practises of hiring, training and supervising teachers for the new activity will need to be regularized. Apart from this relationship of specialization to formalization (cf. Aston studies' 'structuring of activities' dimension), the effect of adding a new specialism on the distribution of power within the system also deserves examination.

There is a theme in organizational writing that the increase in the number of occupational specialties will lead to a decentralization of authority. This has been expressed by Hage as an 'axiom': "The higher the complexity, the lower the centralization".[36] Since the acquisition of a new specialism does add to the complexity of a school organization, it may be expected that its introduction will have an effect on the dispersal of power. It may be seen, then, that 'organic growth' specialisms, though not perhaps as internally significant as those arising from differentiation, may be considered as a manifestation of complexity, defined by Hage and Aiken as the 'utilization of knowledge'. This may be in turn expected to affect the other two major structural dimensions cited by these authors--formalization ('the utilization of rules') and centralization ('the distribution of power').[37]

'Organic growth' does not imply an increase in organizational size, since historical changes may simply require a relocation of, rather than an increase in, resources and personnel. 'Differentiation', however, is clearly associated with pressures arising from internal growth and has traditionally been cited as the model for organizational

change. The choice of one or the other of Clark's models is therefore going to affect any relationship that may be found to exist between specialization, size and history. However, though the application of the 'organic growth' model may yield a different set of items from 'differentiation', it is not expected that, should it be chosen, the effect of size on specialization will be insignificant. Just as personal wealth may have a great bearing on the acquisition of an article of scientific invention, the choice of a particular model for the definition of a 'universe' of items does not preclude the interaction of many factors, both individual and historical, in the innovative process. It would be profitable first to consider the theoretical background to size and history before elaborating their expected interaction in a predictive model.

B. SIZE AND HISTORY

Historically a most important concept in 'classical' theory, size is perhaps the most significant contextual property of an organization and has been the subject of a great deal of recent empirical research in the area of organizational growth. In the review of the literature on this extensive topic by William H. Starbuck,[38] it is possible to discern two distinct analytical emphases: on the one hand, the studies are concerned with the motives, adaptive processes and structural changes associated with the increase in size of a particular organization (Selznick's study of the T.V.A. is a good example),[39] while on the other, an attempt is made to establish general predictive models from a synchronically sampled distribution of size. The two approaches are, of course, complementary and with a sample of similar organizations (e.g. hospitals), have a great deal in common. The sampling methods used for this study, however, lend themselves more to the latter approach and it is to studies that were based on similar

data that we turn for the formulation of a meaningful hypothesis.

F.W. Terrien and D.L. Mills, examining the effects of changing size on the administrative ratios of Californian school districts, based their findings on data from a synchronic sample.[40] Their finding that the ratio of administrative to teaching personnel increased proportionally with size has been the subject of a great deal of controversy, little of which has contributed to the elaboration of the suggestive theory from which the rather limited hypothesis of ratios was derived:

> In as much as one of the most notable characteristics of the contemporary world appears to be a proliferation of formal organizations, the problem of the effects of size per se seems to be deserving of exploration. More specifically, a study of the size relationship of administrative components to their total containing organizations should yield some information about the effect of size upon the nature of intra-organizational structure.[41]

The failure to investigate more deeply the relationship between size and 'intra-organizational structure' has been pointed out by Pugh et al. who attempted to relate a number of contextual properties as independent variables of structural dimensions. Of the three major underlying dimensions of organizational structure, ('structuring of activities', 'concentration of authority', 'line control of workflow size was found to be significantly related to one alone--'structuring of activities'--a composite of scale scores on measures of functional specialization, role specialization, standardization and formalization.[42] The relationship was very strong (r = +.69) which prompted the formulation of a 'developmental sequence' in which specialization is seen as a concomitant of increasing size and impersonality.

> Thus it is possible to see developmental trends in the syndromes of contextual variables associated with the clusters of similarly structured organizations. There is the line controlled, implicitly structured organization, initially small in size (relatively speaking) with a flexible technology ..... With the nascent workflow bureaucracy there are the beginnings of structuring, the appearance of specialists and expansion of procedural control. With the workflow bureaucracy, specialists appear, producing more procedures and reinforcing control by the line with impersonal bureaucratic regulation.[43]

Just how far this sequence applies to school systems is debatable because the term 'specialization', even without its functional definition, is ambiguous. The distinction made by Friedman between 'the specialists' and 'the specialized' is critical here since teaching specialization is accompanied by increased professional training and association. This feature was found in the Aston studies to be characteristic of 'personnel bureaucracies', typified by 'local or central government departments' which, in contrast with 'workflow' bureaucracies', characteristically maintain high scores on 'line control of workflow and 'concentration of authority', but score low on measures of 'structuring'.

> The implication is that when the hierarchy is staffed by professionals, they exercise control directly and personally (line control) and do not develop bureaucratic control routines (low structuring of activities), since the activities of subordinate personnel are governed by professional standards. When such organizations fall within a local government framework of overall statutary control, they are very high on the concentration of authority, and the control of broader policy is taken away from the professionals.[44]

This ambiguity attached to teaching specialization in that it is clearly an example of the specificity of role prescription typical of 'workflow bureaucracies' yet may at the same time foster professional activity can however be resolved by considering it as a crude form of 'structuring'. By implication, it may be hypothesized that teaching specialization will correlate with organizational size.

The second correlate, history, was chosen because of the increasing importance of the subject of this study, expressed by Burton R. Clark as 'the trend towards specialization that has replaced the old schoolmarm with teachers who possess a particular strength'.[45] The locus of this change must, however, be specified, in order to have a precise theoretical value. 'History' is therefore defined here as the external effect of the passage of time on organizational structure. It is therefore to be logically and mathematically distinguished from growth, an internal effect, also a function of time. It is significant, too, that should the criterion variable be defined as a product of diversification

through organic growth it might be expected that an historical effect would be more evident, if the effects of growth on prediction are controlled, than an analysis where specialization was defined purely as a function of internal differentiation.

A discussion of the literature on the theory and empirical study of organizations has shown that the isolation and measurement of structural dimensions from non-subjective data has been a very recent yet fruitful development whose techniques and concepts could well be applied to the study of complex organization in education. The division of labor, historically a most important concept in the literature on bureaucracy, considered as an objective dimension of structure has not yet been studied at the workflow level. This study, which proposes to isolate, measure and to explore the correlates of teaching specialization in school systems represents not only a needed step towards the development of an empirical theory of educational organization but also a potentially significant extension of the theory and techniques of organizational studies into a new area.

FOOTNOTES: CHAPTER II

1. For a list of fourteen more prominent structure analysts who have used the concept of bureaucracy see D.J. Hickson, "A Convergence in Organizational Theory", Administrative Science Quarterly, XI (September,1966), 227. Also see Peter M. Blau and W. Richard Scott, Formal Organizations: a Comparative Approach (San Francisco:Chandler Publishing Co., 1962), pp. 27-36.

2. Writers who have given prominence to the division of labor as a bureaucratic dimension include:
   Max Weber, The Theory of Social and Economic Organization, trans. by A.M. Henderson and Talcott Parsons. Edited with an introduction by Talcott Parsons (Glencoe, Ill : Free Press and Falcon's Wing Press, 1947), pp.329-41.

   Carl J. Friedrich, "Some Observations on Weber's Analysis of Bureaucracy", in Reader in Bureaucracy, ed. by R.K. Merton et al. (Glencoe, Ill.: Free Press, 1949), p. 29.
   R.K. Merton, Social Theory and Social Structure (Glencoe, Ill.:Free Press, 1949), pp.151-52.
   Victor A. Thompson, Modern Organization (New York: Alfred A. Knopf, 1965).
   For a treatment of the broader societal implications of the division of labor, see Emile Durkheim, Division of Labor in Society (Glencoe, Ill.:Free Press, 1949).

3. Max Weber, The Theory of Social and Economic Organization, pp. 329-41.

4. D.S. Pugh et al., "A Conceptual Scheme for Organizational Analysis", Administrative Science Quarterly, VIII(December, 1963), 289-315.

5. R.H. Hall, "The Concept of Bureaucracy: an Empirical Assessment", American Journal of Sociology, LXIX (July, 1963), 32-40.

6. Typical of the perceptual emphasis in Hall's methods is this item designed to measure the division of labor: "One thing people like around here is the variety of work.". Ibid., 35.

7. Peter M.Blau, Wolf V. Heydebrand and Robert E. Stauffer, "The Structure of Small Bureaucracies", American Sociological Review, XXXI (April, 1966), 179-92.

8. D.S. Pugh et al., "Dimensions of Organizational Structure", Administrative Science Quarterly, XIII (June, 1968), 65-105.
D.S. Pugh et al., "The Context of Organizational Structures", Ibid., XIV (March, 1969), 91-114.
D.S. Pugh, D.J. Hickson and C.R. Hinings, "An Empirical Taxonomy of Structures", Ibid., XIV (March, 1969), 115-126.

9. N. Gross, W.S. Mason and A.W. McEachern, Explorations in Role Conflict: Studies of the School Superintendency Role (New York: Wiley and Sons, 1958).
For a thorough review of administrative theory that bears out the importance of perceptual studies in this area, see Daniel E. Griffiths, "Administrative Theory", Encyclopedia of Educational Research, 4th ed., 17-24.

10. J.K. Hemphill and A.E. Cooons. Leader Behavior Description (Columbus: Ohio State University Press, 1950).

11. For an application of Hall's instruments to educational organization, see David Allister McKay, "An Empirical Study of Bureaucratic Dimensions and Their Relationship to other Characteristics of School Organiation" (Unpublished Ph.D. Dissertation, University of Alberta, 1964).
For other studies using perceptual instruments for the measurement

of the intensity of bureaucratic variables in school systems, see: Terrence Russell McKague, "A Study of the Relationship Between School Organization and Behavior and the Variables of Bureaucratization and Leader Attitude" (Unpublished Ph.D. Dissertation, University of Alberta, 1969) and Halim Barakat, "Alienation from the School System: Its Dynamics and Structure" (Unpublished Ph.D. Dissertation, University of Michigan, 1966).

12. F.W. Terrien and D.L. Mills, "The Effect of Changing Size upon the Internal Structure of Organizations", American Sociological Review, XX (February, 1955), 11-13. For studies that investigate Terrien and Mills's hypothesis in the Alberta context, see Norman Gill, "The Relationship between the Size of Urban School Systems in Western Canada and Certain Characteristics of their Administrative Staffs" (Unpublished M.Ed. Thesis, University of Alberta, 1967). Kurivilla Aaron Vithayathil, "Administrative Ratio and Threshold Sizes of Administrative Offices in Alberta School Systems", (Unpublished M.Ed. Thesis, University of Alberta, 1969).

13. Ronald G. Corwin,"Education and the Sociology of Complex Organizations", in On Education---Sociological Perspectives, ed. by Donald A. Hansen and Joel E. Gerstl (New York: Wiley and Sons, 1968), Chap. v, pp. 156-223.

14. Ibid.,p. 168.

15. Charles E. Bidwell, "The School as a Formal Organization", in Handbook of Organizations, ed. by James G. March (Chicago: Rand McNally, 1965), Chap. xiii, pp. 927-1022.

16. Corwin, "Education", p. 169.

17. Bidwell, "The School", p. 1012.

18. Corwin, "Education", p. 169.

19. Weber, Social and Economic Organization, p. 333.

20. See footnote 2, also Hall, "Bureaucracy", 34.

21. D.J. Hickson, "A Convergence in Organization Theory", 225-37.

22. Georges Friedmann, The Anatomy of Work: Labor and the Implications of Automation, trans. by Wyatt Rawson (New York:Free Press, 1961).

23. Gerald Hage and Michael Aiken, "Relationship of Centralization to other Structural Properties", Administrative Science Quarterly, XII (June, 1967), 72-92.

24. Blau et al., "Small Bureaucracies", 179.

25. Pugh et al., "Dimensions of Organizational Structure", 73.

26. Ibid., 85.

27. Joseph P. Farrell, "Guttman Scales and Evolutionary Theory", Sociology of Education, XLII (June, 1969), 271-83.

28. Bidwell, "The School", p. 974.

29. Corwin, "Education", p. 217.

30. Ibid., p. 197.

31. Government of the Province of Alberta, The School Act: being Chapter 37 of the Revised Statutes of Alberta, 1955 with amendments up to and including 1958. (Edmonton:Queen's Printer, 1958), Part XII, Sec. 330.

32. Terry N. Clark, "Institutionalization of Innovations in Higher Education: Four Conceptual Models", Administrative Science Quarterly, XIII (June, 1968), 1-25. Although the 'diffusion model' may explain the range of possible specialisms, it is more likely that of all the external pressures for innovation, those associated with 'organic growth' will be the more powerful.

33. Ibid., 3.

34. Ibid., 9.

35. John W. Chalmers, Schools of the Foothills Province, Chap. xii "From Industrial Arts to Vocational Education".

36. Gerald Hage, "An Axiomatic Theory of Organizations", Administrative Science Quarterly, X (December, 1965), 299.

37. Hage and Aiken, "Centralization", 91.

38. William H. Starbuck, "Organizational Growth and Development", in Handbook of Organizations, ed. by James G. March, Chap. xi, pp.451-533.

39. P. Selznick, T.V.A. and the Grass Roots (Berkeley: University of California Press, 1949).

40. Terrien and Mills, "Changing Size".

41. Ibid., 11.

42. Pugh et al., "Context of Organizational Structures", 97.

43. Pugh et al., "An Empirical Taxonomy", 124.

44. Ibid., 119.

45. Burton R. Clark, "Sociology of Education", in Handbook of Modern Sociology ed. by Robert E. Farris (Chicago: Rand McNally,1965), p.758.

CHAPTER III

OPERATIONAL DEFINITIONS AND SAMPLING

A. OPERATIONAL DEFINITIONS

An attempt may now be made to definite 'specialization'. First a general definition will be stated which will give orientation to the application of Corwin's definition to the Alberta context. At the end of the discussion it is hoped that a specific and theoretically satisfactory set of specialisms will emerge. Before a definition is pursued, however, two statements from similar studies applicable to this study deserve consideration:

> It should be stressed at the outset that the units of analysis were the organizations, not the individuals in the organizations. (Hage and Aiken).[1]

> The variables under consideration must be structural characteristics of the bureaucracies themselves, such as status distribution in the organization, rather than merely attitudes or behavior of the individuals in the organization. (Blau et al.)[2]

Adopting these principles, therefore, specialization is to be considered synonymous with the division of labor, an organizational characteristic, not to be confused with the particular qualifications and training of the individuals, though the latter may serve as a guide to possible operational categories. The definition of specialization used in the Aston studies---'the distribution of organizational tasks among positions as official duties'---[3] will serve as a starting point. From this point the definition may be limited further for the narrow operational purposes of this study, by the insertion of 'workflow' or 'line' before the word 'positions' in the definition. This will include only those school-based positions that require a teaching certificate, outside the line of supervision. A specialism may then be defined, in a general sense, as a non-supervisory teaching position arising directly from the distribution of organizational tasks as official duties.

These general defintions will serve as a framework within which the set of specialisms remains to be specified. Identification of possible specialisms is not difficult; organizational theory, however, demands that, to be of any value, the universe chosen for scaling is not simply an operationally convenient grouping, but a theoretically justifiable set. The criteria for achieving homogeneity suggested by Terry N. Clark's models of innovation would perhaps be best applied after a discussion of the possible ways of identifying specialized activities in schools. The following possibilities for a classification basis will be dealt with in turn: levels of instruction, subject areas, categories of qualification or certification, designations of specialty in official documents.

Classification by level of instruction offers a valid possibility, but unfortunately since such a vertical division is found in almost every system, it neglects the more interesting effects presented by horizontal division within any one level. It should be noted that Corwin does not consider this a possibility. Subject area specialisms appear, on the other hand, the most logically satisfactory method of deriving categories yet such a method of classification seems fraught with operational difficulties. Since individual teacher specialization in some subject areas, (e.g. industrial arts) is mandatory for their addition to a school, in other areas, notably the 'core' subjects, specialization is more a function of school or system size, we are presented with a qualitative problem. To equate one type of subject specialization with another would lead to much the same kind of heterogeneity yielded by Corwin's operational categories.

Specialisms derived from training and certification requirements, even though they lead to personal rather than to organizational description, may however serve as indicators. An examination of faculty handbooks in Education over the years 1950-70 shows a recognition of the principle of 'specialization', implying a distinction between 'usual' or 'general' routes to the B.Ed., and those 'specialist' ones such as industrial arts and home economics.[4] This would appear to

reinforce the qualitative distinction in the previous paragraph between subject areas where 'specialization' is mandatory both in training and in the performance of duties. This distinction is also manifested in the growth of the so-called 'specialist' certification that was instituted in twelve teaching areas from the mid 1930's to the late 1950's.[5] Why the uniformly non-academic subject areas should have been defined as 'specialist' while there was a tendency towards specialization in the humanities and sciences is difficult to explain other than by the fact that rapid curriculum diversification accompanying the increase in high school attendance led to ambiguity in the status of personnel who would fill the newly-created positions.[6]

Categories on official documents offer a dubious basis for a classification of specialized activities, yet may point to important organizational processes. The Secretary-Treasurer's Report for the school boards of Alberta lists eleven specific designations, substantially the same as those that were listed for special certification.[7] The Alberta Teachers' Association's return for individual teachers lists some of the positions designated as 'specialist' as against that of 'regular classroom teacher'. Though incomplete, the list would presumably look something like that of the previously cited Report.[8]

From this discussion, there arises an empirical basis for a workable and theoretically satisfactory definition of specialized activity. It would appear, first that certain categories of specialization have arisen from the diversification of curricula and services, while others have arisen by a differentiation within a traditional 'core'. It appears, too, that the former process has been paralelled by a similar diversification of teacher education routes and that teachers tend to be employed on a full-time basis within these areas of specialization. These designations were given, at one time, specialist status in provincial certification and are distinguished from 'regular classroom' teachers in official and semi-official

documents. A strong factual basis is therefore made for a distinction between those activities that have their structural origins in Clark's "organic growth" model and those that originate by his model of "differentiation."

The link between these empirical distinctions and Clark's models of innovation is provided by the fact that it was external political pressures, and the consequent curriculum revisions that instituted the non-academic options into the junior and senior high schools.

Describing the process of curriculum revision in the early decades of the century, Byrne, an historian of education in Alberta writes:

> while the first revision was initiated and developed by those directly concerned with the schools, the second had a wider measure of public support. The attempt to discover public opinion on the desirable direction for curriculum change displayed an interesting departure from tradition in public leadership. The structures established for the revision of the elementary school program by the Liberal government, a pattern to be followed later by the United Farmers for the secondary schools, was a further illustration of a broader and more democratic approach to curriculum planning.

This second revision of 1922 instituted a new program which provided for six high school courses---normal entrance, university entrance, agricultural, commercial, technical and general. The most durable revision--that of 1935, expanded the number of options to include a wide variety of non-academic subjects, including music, typewriting, dramatics, art, home economics and industrial arts. According to Byrne, the previous revisions were unacceptable because 'the six-track design failed to meet the special needs of a predominantly rural province'. With the exception of vocational education, which was also innovated through political and economic pressures,[10] the range of course offerings instituted in 1935 remains virtually unaltered.

For the purposes of this study, therefore, the 'organic growth' model of innovation will be used as the basis for an

operational definition for distinguishing those organizational activities designated as 'specialized' from others. Excluded will be those derived from hierarchy, level of instruction or from differentiation of role. The definition will include only those activities such as industrial arts, home economics, vocational education, physical education, guidance and fine arts that have come to be specialized through external pressures for innovation rather than through an internally driven dynamic for the creation of additional positions within a pre-existing area.

A 'teaching specialism' is here operationally defined as an activity added to a school as a function of the historical diversification of curricula and services rather than as a function of the internal differentiation of tasks and roles.

B. SAMPLING

We now turn to the organizations from which the sample will be drawn---the school systems of Alberta. After discussing their characteristics, sampling considerations will be specified.

There are four distinct types of educational organization in Alberta: public and separate school districts, school divisions, city school districts and counties. Each of these organizational types has a unique constitution as laid down in the School Act or in the County Act of the Province. Because they are not all, strictly speaking, school 'boards', the word 'system' will be used as a general term to describe these organizations. A brief description of the characteristics of each type provides a useful background for the consideration of any particular sample.[11]

The district is historically the basic unit of administration, usually sixteen to twenty square miles in area, often built round a village or town. Most districts have been incorporated into larger school administration units. Separate school districts, on the other

hand, which comprise about half of the total population of the independent systems of the province, are with few exceptions, Roman Catholic, rarely with more than twenty teachers and dependent for inspection and supervision on the county or division in which they are embedded. Districts are governed by three to five annually elected trustees who appoint a secretary-treasurer.

School divisions were introduced in 1937 when several school districts surrendered their powers to a general administrative board. The movement towards centralization of administration, and later of instruction, grew during the decade following World War II. The average division covers some two thousand square miles and includes at least one fairly large center. In 1966 there were thirty-three divisions in operation employing between sixty and eighty teachers. Divisions are governed by boards of between three and five trustees who appoint a chairman, a secretary-treasurer and an auditor. Superintendents have been provincially appointed.

City school districts have been the most enduring form of organization. Formed as they were originally, around the large centers of population, they contrast with the rural and village public districts which have almost disappeared. There were in 1966, eight public and nine separate school city districts, employing between them well over half the teachers of the Province. The group is extremely heterogeneous with respect to size, however. Three separate school districts employ under thirty teachers each, in contrast with the two largest systems in the Province, the public city school districts of Edmonton and Calgary, which each employ over three thousand. The constitution of city boards is similar to that of independent school districts, although the School Act does not limit the number of trustees in their case.

County organization is unique in that both municipal government and educational functions are subsumed by the same elected body---the county council. This body consists of two working committees, municipal and school, the latter being composed

of at least three members of the county council and a representative from each included town council, rural school district or other subdivision. The County Act of 1950 and the Revised Act of 1955 provided for 'coterminous' municipal and educational boundaries, and since 1951 twenty-seven counties have been organized, employing on the average in 1966, about one hundred and fifty teachers.

This description of the educational organizations in Alberta leads us to conclude that, because of the great range in ecology, size, and formal control that is revealed, it would be well to treat them, for the purposes of sampling, as four distinct populations. Within each sample category, in light of its importance in previous studies, size should be a major sampling consideration. This latter variable was measured by the number of teachers, following a similar index, 'number of employees', used in the Aston studies,[12] and in numerous studies of organizational growth.[13]

The Secretary-Treasurer's Report was chosen as the major source of data. This document contained precise information as to the distribution of almost the full range of specialisms that came under the above definition among the majority of the systems of the Province over a period of several years. Before the data that the Reports yielded may be accepted however, they must be subjected to procedural and theoretical scrutiny.

With permission of the staff of the Division of Field Services of the Alberta Department of Education, the relevant page (Appendix 'C') was photographed from all reports filed from school year 1965-6 through 1968-9, yielding a total of 292 observations. From these data, it was necessary to exclude those categories which were in the line of supervision (principals, vice-principals and department heads), those not indicating specialization (relieving teachers) and one category in which there were only a few occurrences (Oral French). This left a total of ten specialisms, to which only a few that could be included under the definition, such as art and dramatics, could be added. The items sampled were therefore a

good representation of the theoretically defined universe. The ten specialisms observed were: opportunity, physical education, industrial arts, home economics, commercial, reading, library, guidance, music and vocational education.

Among the 292 observations made, 160 were of the same systems over four years, 84 over three and 34 over two and 14 of one. The total number of systems in the sample was ninety-nine. It remains now to compare the size of the systems sampled, since this was to be a major consideration, with that of the total population of systems for each category within each year observed (Table 3 : 1). It would appear from the table that mean sample size and mean population size are negligibly different except for city districts and for separate and public school districts.[13] In the first instance, the fact that the three largest school systems (Calgary Public, Edmonton Public and Edmonton Separate) in the Province were not included lowered drastically the mean sample size; it was apparent however, that these boards were so far beyond the upper threshold size for the possible specialization score (i.e. 10) that their exclusion would have had little significance. In the second instance, a lower mean population size was a result of excluding the considerable number of smaller boards in their grouping that almost uniformly possessed no specialisms. The 'fit' by size, of the sample to the populations, is therefore acceptable, since that deviation that does exist may be construed as a threshold effect of minor theoretical importance.

TABLE 3 : 1

COMPARISON OF SAMPLE AND POPULATION SYSTEMS BY MEAN SIZE (NO. OF TEACHERS).*

		1965		1966		1967		1968	
		SAMPLE	POP.	SAMPLE	POP.	SAMPLE	POP.	SAMPLE	POP.
DIVISIONS	MEAN NO. OF TEACHERS	96	96	102	103	101	104	98	110
	NO. OF SYSTEMS	27	31	27	32	26	33	22	31
COUNTIES	MEAN NO. OF TEACHERS	121	126	118	128	120	134	122	138
	NO. OF SYSTEMS	24	28	24	28	20	28	19	30
CITY DISTRICTS	MEAN NO. OF TEACHERS	149	450	140	528	154	579	186	623
	NO. OF SYSTEMS	12	17	13	17	13	17	11	17
PUBLIC & SEPARATE DISTRICTS	MEAN NO. OF TEACHERS	39	17	33	17	46	18	51	24
	NO. OF SYSTEMS	16	87	9	82	8	81	12	77

* Source: Alberta Department of Education, Annual Report, 1964-65 through 1967-68. (Edmonton: Queen's Printer).

Because the substantial accuracy of these documents could be assumed and the samples of both specialisms and systems therein described are theoretically acceptable, it was decided to rely on them as the major source for the measurement of specialization. Following the method of endorsement of the Aston studies, described in Chapter I, a score of unity was allotted for the possession of each of the ten specialisms for each observation. The data thus derived are displayed in Appendix 'A'.

FOOTNOTES: CHAPTER III

1. Gerald Hage and Michael Aiken, "Relationship of Centralization to other Structural Properties", Administrative Science Quarterly, XII (June, 1967), 75.

2. Peter M. Blau, Wolf V. Heydebrand and Robert E. Stauffer, "The Structure of Small Bureaucracies", American Sociological Review, XXXI (April, 1966), 180.

3. P. Levy and D. Pugh, "Scaling and Multivariate Analyses in the Study of Organizational Variables", Sociology, III (May, 1969),194. D.S. Pugh et al., "Dimensions of Organizational Structure", Administrative Science Quarterly, XIII (June, 1968), 72.

4. "Faculty of Education", University of Alberta Calendar, 1949-50 through 1969-70 (Edmonton: University of Alberta Printing Services). Specifically Calendar 1950-51, p. 222 and Calendar 1961-2, pp. 234-5.

5. Alberta Department of Education, Regulations Governing the Certification of Teachers, Effective May 17, 1954, (Edmonton: Queen's Printer, 1954), p. 6; also John W. Chalmers, Schools of the Foothills Province: the Story of Public Education in Alberta (Toronto: University of Toronto Press for the A.T.A., 1967), p. 198.

6. Donald Roy Cameron, Teacher Certification in Canada: Information Bulletin 60-2 (Ottawa: Research Division, Canadian Teachers' Federation, 1960), p. 91.

7. Alberta Department of Education, Secretary- Treasurer's Report, Official Annual Return, p. 12. (See Appendix 'C').

8. J.E. Wicks and M.T. Sillito, The Alberta Teaching Force: Research Monograph No. 15. (Edmonton: The Alberta Teachers' Association, June, 1969), p. 42, Appendix 'A' 4.

9. T.C. Byrne, "The Historical Development and an Evaluation of Provincial Leadership in the Field of High School Instruction in the Province of Alberta" (Unpublished Ph.D. Dissertation, University of Colorado, 1956), p. 159, p. 185. Quoted by Chalmers, Schools of the Foothills Province, pp. 195-7.

10. Ibid., p. 216.

11. Dominion Bureau of Statistics, The Organization and Administration of Public Schools in Canada. 3rd. ed. (Ottawa: Queen's Printer for the Minister of Trade and Commerce, 1966), Chapter iii.

12. D.S. Pugh et al., "The Context of Organizational Structures", Administrative Science Quarterly, XIV (March, 1969), 97.

13. William H. Starbuck, "Organizational Growth and Development", in Handbook of Organizations, ed. by James G. March (Chicago: Rand McNally, 1965), Chap. xi.

CHAPTER IV

THEORY AND PROCEDURE OF SCALING

As Levy and Pugh maintain, in an article which examines the relevance of psychometric techniques to the study of organizations, the choice of a measurement technique is a theoretical consideration of prime importance, since it is an extension on to a mathematical plane of the concepts used to describe and interpret organizational behavior.[1] This view is relevant in the context of this study, since the measurement device chosen will have to provide indices as to whether a theoretically homogeneous set of activities constitutes a dimension of organizational structure. The importance of choosing the right technique both for predicting the behavior of the sample data and for deriving correlates among other dimensions of structure and of context cannot be exaggerated.

The most obvious method of measurement is that used by earlier researchers such as Hage and Aiken, of simply counting the number of operationally defined categories held by individual organizations.[2] While this method is attractive because of its operational simplicity, it fails to yield theoretically significant information about the data and thereby perhaps makes some unjustifiable assumptions. The matters of internal consistency, of inhibition of some items by others and of correspondence between score and variable are ignored by simply adding up the number of specialist activities. The discovery of a predictable order of item addition,that is, of a unidimensional pattern, in the distribution of specialisms would, however, satisfy all of these considerations. It is of prime concern, then, for the isolation of a single dimension of specialization, that the measurement technique test for such a pattern. Before considering the possible measurement techniques individually, it is necessary to adopt the criterion for endorsement of a specialism used in the Aston studies--'that the particular specialization is performed by one or more persons full-time'.[3] Three kinds of measurement are possible for treating the binary data which such a

scoring method yields--Guttman scalogram analysis, item analysis and factor analysis.

The first, Guttman scalogram analysis, was developed during World War II in the construction of attitude scales and has been widely used as a device for establishing the scalability of qualitative data. The distribution of item occurrence in a perfectly unidimensional pattern would yield a reproducibility coefficient of unity. This technique, then, suits the specifications cited above for a measurement device, since it is a necessary implication of a high coefficient both that the items are internally consistent and that the ordinal relationship between individuals corresponds to that between items, indicating that the scores are measures of a single variable.[4] The technique has been further refined by Goodenough to ensure that the specification of true reproducibility of items from scale score is met.[5] The test presumes, as Guttman stresses, 'that the universe is already defined'.[6]

Item analysis, which is generally based on the correlation between item scores and total score, is most commonly used as a test for internal consistency. However, the limitations of the technique for ascertaining the internal structure of a set of items are quite serious. As Guttman points out:

> Item analysis does not attempt to see how well items can be reproduced from the total score, but rather it attempts to do <u>just the opposite</u>; item analysis investigates how well the total score can be estimated from each item separately. This is a crucial distinction. Scale analysis regards the score as a representative of the items; the score is to be a means of representing the items in any situation, which will be possible if each of the items is perfectly related to the score. The <u>converse</u> is done by item analysis; here the item is supposed to represent the score.[7]

The objections made here to item analysis generally could be made ot its particular variant, the Brogden-Clemans coefficient used in the Aston studies which tests the discriminatory power of individual items, but gives no indication as to whether their internal structure is unidimensional or otherwise.[8]

Factor analysis, a method for extracting related sets of items from raw data, has been compared with the above techniques by both Guttman and by Levy and Pugh. Its applicability to qualitative binary data for the purpose of establishing rigorous scalability would appear to be limited.

> When it comes to qualitative data, two of the basic features are lacking which can be present in the quantitative case. There are, in general, no simple analytical expressions like linear equations and their associated product-moment correlation coefficients for expressing relationships between items ..... The problems of prediction and and correlation for qualitative data are quite different from that of quantitative data.[9]

> The linear equation allows two or more organizations to achieve the same score on a factor by different combinations of sclae scores ..... In fact, Guttman scaling of this particular variable specifically limits the possibility that the same score can be achieved by different routes, whereas factor analysis clearly does not and assumes a compensatory theory.[10]

In the choice of a measurement technique, Coombs's distinction between a scaling method and a scaling criterion is apt.[11] If the problem were structured so that it was required to select a set of items that were the most powerful predictors of a certain variable, then item analysis would be most useful. Since the problem is, however, to determine whether or not the model of unidimensionality fits the distribution of a fairly rigidly specified number of items, then the Guttman technique is most appropriate. In addition, the feature of reproducibility may have a practical application in the prediction of the future additions of specialisms to a particular system. For these reasons therefore, the Guttman scalogram analysis with the Goodenough technique was chosen.

Since it is an accepted and well-documented procedure a brief description of the Guttman-Goodenough technique and of its criterion measures will perhaps be sufficient to the purposes of this study. In the light of this description, the applicability of the

scaling criteria to the type of data used in organizational research will be onsidered in order to formulate decision rules for this study.

The basic principle of the scale is that 'the items have an order such that, ideally, persons who answer a given question favorably all have higher ransks than persons who answer the same question unfavorably'.[12] In practice, of course, this perfect pattern does not hold, and deviation from perfection is measured by the coefficient of reproducibility which is 'simply the empirical relative frequency with which values of the attributes do correspond to the proper intervals of a quantitative variable'.[13] A coefficient of .90 or better is taken generally as an acceptable index of the scalability of any universe. However, as Guttman points out, the coefficient of reproducibility is not always a significant indicator or scalability, since the coefficient gives no account of the nature of discrepancies from the pattern. Other criteria are therefore proposed. These are: the range of marginal distributions, the pattern of errors and the numbers of items and response categories included in the scalogram. Since there are ten items in the proposed scale, and since the scoring is dichotomous (i.e. 1 or 0), these last-mentioned specifications have been met. The first two--the range of marginals and the pattern of errors--however, are relevant to this study.[14]

Since a coefficient of reproducibility may be spuriously inflated by the inclusion of items that have a high marginal (or modal) reproducibility, Guttman recommends that 'attempts be made to include in the sample as wide a range of marginal distributions as possible', and specifically, to include items with marginal distributions around 50-50.[15] In the latter instance, since the 'pattern of errors' may indicate the presence of more than one major variable in the area, Guttman and Suchman propose inspection of 'the gradient of errors' and the identification of 'non-scale types'[16] to ensure, as Levy and Pugh explain, 'that discrepancies from perfect pattern should appear close to the pattern in the ordinal sense'.[17]

What should be done therefore, if either one of these indications of a possibly inaccurate deduction occur simultaneously with a high

reproducibility coefficient in the course of scaling organizational specialisms? Should a hypothesis as to the scalability of the area be rejected? The question is a difficult one and can only be answered by a consideration of operational priorities. In the case of the pattern of errors, is it more important that individual specialisms and organizations be found to deviate from a pattern than that a defined distribution be found scalable? Theoretically, the discovery of high reproducibility in an area is of greater initial significance than the consequent identification of those types which 'occur with sufficient frequency not to be noticed but not with enough frequency to substantially impair the reproducibility of an area from a dominant variable'.[18] As Levy and Pugh indicate:

> In the multi-dimensional case, we are encouraged that data generated by the joint operation of several factors can still have a strong unidimensional core which may serve as a first-step summary of the data.[19]

What should be done in the case of items that have almost perfect reproducibility from their marginal distributions? The answer lies in a consideration of the nature of the data. Whereas the Guttman technique was developed on questionnnaire data, with a view to selecting a set of scalable items, the problem here is to test the scalability of a defined universe. The fact that the specialisms have a theoretical, as well as a mathematical status, requires that the criterion of marginal reproducibility be more flexibly applied. For example, a certain grouping of school systems may nearly all be found to possess an industrial arts specialism, which may increase the overall marginal reproducibility of the area, yet it would be a mistake to reject this specialism, as with one with a very low incidence, simply for the sake of raising the 'coefficient of scalability'[20] to an acceptable level. Hickson and Thomas, in a discussion of a Brogden-Clemans scale for professionalism, are confronted with a theoretically similar, though necessarily mathematically different, consideration. They decide in favor of retaining an item with a low coefficient because 'a judgement

has to be made on the appropriateness of each item which takes into account both its coefficient and its conceptual relevance'.[21]

Obviously there are limits to the application of the principle of making statistical exceptions on the basis of theory and it is not expected that more than one or two items with high marginal reproducibility will be permitted in any one scale.

Because of the heterogeneity of the sample, it was thought necessary to group observations, before scaling, in three different ways: by organizational type, by size (arbitrarily divided into groupings, of approximately equal numbers, of systems over and under 100 teachers) and, since single year groupings did not yield large enough numbers in some cases, by two-year spans (i.e. 1965-66, 1967-68). All of the sixteen groupings this yielded were considered initially to have a potentially unique scaling pattern and were not combined until it was possible to establish their similarity by a rigorous index. In this case, the rank order of item difficulty was taken as the characteristic of comparison. A Spearman's 'rho' of .95 or higher was considered an indication that two or more groupings could be combined.[22] Those groupings that did not scale on the first trial were to be rescaled in order to test for possible sub-universes by grouping separately 'low error' and 'high error' items. A lower limit for acceptable reproducibility (.85) than that normally set was adopted because the large number of groupings were based on the same data and it was expected that combined groupings would possibly yield higher coefficients.

The decision rules behind the scaling procedure may therefore be stated:

1. A set of specialisms distributed within a particular grouping of observations based on year of observation, size or organizational type will be considered scalable if analysis yields a coefficient of reproducibility of .85 or higher.

2. Two or more scalable groupings will be considered measurable by a common scale if a correlation (Spearman's 'rho') of rank order of item difficulty between original scales is .95 or higher.

The scaling procedure is expressed in the form of a flow-chart (Table 4:1).

TABLE 4 : 1

FLOW CHART FOR SCALING PROCEDURE

Phase 1. Do the ten specialisms scale?				Phase 2. Can scalable groupings be combined?	
	A. By Organ'l Type	B. By Size	C. By Year	A. Within Org. Gps.	B. Bet'n Org. Gps.
1. Divisions	YES	YES	YES	YES	
	NO*	NO*	NO*	NO	
2. Counties	YES	YES	YES	YES	
	NO*	NO*	NO*	NO	
3. City Dist's.	YES	YES	YES	YES	YES
	NO*	NO*	NO*	NO	NO
4. Pub. & Sept. Dist's.	YES	YES	YES	YES	
	NO*	NO*	NO*	NO	

* Break up ten-item scales---test for two sub-universes of five items each.

It is now possible to state the hypotheses for scaling.

Hypothesis I : For the school systems sampled, within groupings of observations based on size, type and time of observation, it will be possible to show by the Guttman-Goodenough technique that the specialisms chosen will form one scalable universe.

Hypothesis II : For the school systems sampled, it will be possible to establish similarity of scaling pattern between groupings of observations based on size, type and time of observation.

FOOTNOTES: CHAPTER IV

1. P. Levy and D. Pugh, "Scaling and Multivariate Analyses in the Study of Organizational Variables", Sociology, III (May, 1969), 193-213.

2. Gerald Hage and Michael Aiken, "Relationship of Centralization to other Structural Properties", Administrative Science Quarterly, XII (June, 1967), 85.

3. D.S. Pugh et al., "Dimensions of Organizational Structure", Administrative Science Quarterly, XIII (June,1968), 73.

4. Louis Guttman, "The Basis for Scalogram Analysis", in Measurement and Prediction, ed. by Samuel A. Stouffer et al.,Vol. IV of Studies in Social Psychology in World War II, ed.by Frederick Osborne et al., 4 vols. (Princeton: Princeton University Press, 1950).

5. W.H. Goodenough, "A Technique for Scale Analysis", Educational and Psychological Measurement, IV (October, 1944), 179-90.

6. Guttman, "Scalogram Analysis", 85.

7. Ibid., 184.

8. Levy and Pugh, "Organizational Variables", 198-200.

9. Guttman, "Scalogram Analysis", 192-3.

10. Levy and Pugh, "Organizational Variables", 209.

11. C.H.Coombs, A Theory of Data (New York: John Wiley and Sons, 1964), p. 81. Cited by Levy and Pugh, "Organizational Variables", 200.

12. Samuel A. Stouffer, "Scaling and Scale Theory", in Measurement and Prediction, 9.

13. Guttman, "Scalogram Analysis", 64.

14. Ibid, 78-80.

15. Ibid., 78.

16. Ibid., 79 and Edward A. Suchman, "The Utility of Scalogram Analysis", in Measurement and Prediction, Chapt.V.

17. Levy and Pugh, "Organizational Variables", 97.

18. Guttman, "Scalogram Analysis", 78.

19. Levy and Pugh, "Organizational Variables", 203.

20. The 'coefficient of scalability' is derived from two other indices:
    (a) the 'minimum marginal reproducibility' (MMR) which is the lowest 'coefficient of reproducibility' (CR) that could have resulted from modal score patterns for each item.
    (b) The 'percent improvement' (PI) which is the difference between MMR and CR.

    The 'coefficient of scalability' is obtained by dividing PI by (1-MMR).

    Norman H. Nie, Dale Bent and C. Hadlai Hull, Statistical Package for the Social Sciences: Provisional Users' Manual, November, 1968, XIV-13.

21. D.J. Hickson and M.W. Thomas, "Professionalization in Britain", Sociology, III (January, 1969), 52.

22. George A. Ferguson, Statistical Analysis in Psychology and Education, 2nd. ed. (New York: McGraw Hill, 1966), pp. 216-20.

CHAPTER V

PRESENTATION AND DISCUSSION OF RESULTS OF SCALING

A. PRESENTATION

Table 5 : 1 presents the decisions made while following through the procedure mapped out by the flow-chart (Table 4 : 1).

TABLE 5 : 1

RESULTS OF SCALING PROCEDURE : FLOW CHART DECISIONS

Phase 1. Do the ten specialisms scale?			Phase 2. Can scalable groupings be combined?	
A. By Org.Type	B.By Size	C.By Year	A. Within Org. Gps.	B. Bet'n Org. Gps.
1. Divisions YES	YES	YES	YES	YES
2. Counties YES	YES	YES	YES	YES
3. Cities YES	YES	YES	NO	NO
4. Districts NO-YES*	N/A	YES	YES	NO

* Two five-item sub-universes discovered.

An analysis of this table reveals that groupings of divisions and counties were scalable not only for all years and sizes, but that it was possible to measure both types by a common ten-item scale. In the case of the city districts, the scale that was found to be stable over time was not found to be so between groupings based on size, (i.e. over and under 100 teachers). Nor were either of these scales comparable with the common scale found for both divisions and counties. In the case of public and separate school districts, low initial reproducibility led to a rescaling of observations to test whether or not two or more scalable sub-tests could be discovered among the ten specialisms. By separating those items with a high error yield from the others, two five-item scales were developed; these were found to be stable over time but the fact that this grouping had few instances of observations with a hundred teachers or more precluded a breakdown in size for these sub-scales. Detailed results on which the above decisions were based are found in Table 5:2.

It is seen in Table 5 : 2 that coefficients of reproducibility were uniformly over the hypothesized level of .85. Highest coefficients were found among groupings of city districts and of counties, ranging from .88 to .94; lowest coefficients were found among divisions, ranging from .85 to .87. Although the initial coefficient for districts (.80) was unacceptable, the two five-item scales for this grouping yielded quite high coefficients (.90). Coefficients of scalability (indicators of marginal distributions) were also quite acceptable except in the cases of smaller divisions (.32) and city districts (.40) where low occurrence of some items boosted the minimum marginal reproducibility. Both criteria for scaling--acceptable coefficients of reproducibility and wide range of marginals--are met therefore.

Application of the criterion for combining scalable groupings (.95 correlation of item order) revealed that scales developed on groupings of an organizational type (counties, cities etc.) were quite comparable over size (under and over a hundred teachers) and stable over the four years observed. The only exception

TABLE 5 : 2

DETAILED RESULTS OF SCALING PROCEDURE

GROUPING	C. of R.	C. of S.	SCALE ITEMS IN ASCENDING ORDER OF OCCURRENCE									
			10	9	8	7	6	5	4	3	2	1
DIVISIONS	.8608	.5120	Read.	Voced.	Guid.	Opp.	Mus.	P.E.	Comm.	Lib.	Homec.	I.A.
Over 100	.8783	.5130	"	"	"	"	"	Comm.	P.E.	"	"	"
Under 100	.8529	.3231	"	"	"	"	"	P.E.	Comm.	"	"	"
1965-6	.8630	.4861	"	"	"	"	"	"	Lib.	Comm.	"	"
1967-8	.8542	.5172	"	"	"	"	"	"	Comm.	Homec.	Lib.	"
COUNTIES	.9146	.6622	Read.	Voced.	Guid.	Opp.	Mus.	P.E.	Comm.	Lib.	Homec.	I.A.
Over 100	.0998	.5619	"	"	"	"	"	"	"	"	"	"
Under 100	.9158	.457	Voced.	Read.	Opp.	Mus.	Guid.	P.E.	"	"	"	"
1965-6	.9292	.6881	Read.	Voced.	"	Guid.	Mus.	"	"	"	"	"
1967-8	.8929	.6071	"	"	Guid.	Opp.	"	"	"	"	"	"
CITY DISTS.	.8920	.6376	Read.	Opp.	Guid.	Mus.	Voced.	P.E.	Comm.	Lib.	Homec.	I.A.
Over 100	.9467	.8072	"	"	Mus.	Guid.	"	Lib.	I.A.	P.E.	Comm.	Homec.
Under 100	.8800	.4000	"	Guid.	Opp.	P.E.	Mus.	Comm.	Voced.	Lib.	I.A.	Homec.
1965-6	.9083	.7067	"	Opp.	Mus.	Voced.	Guid.	P.E.	Comm.	"	"	"
1967-8	.8923	.6000	"	"	Guid.	Mus.	Voced.	"	"	"	"	"
PUB.&SEP. 'A'	.9000	.6623						Voced.	Mus.	Comm.	Homec.	I.A.
DISTS. 'B'	.9000	.5789						Read.	Guid.	Opp.	Lib.	P.E.
1965-6 'A'	.9030	.6800						Voced.	Mus.	Comm.	Homec.	I.A.
1967-8 'A'	.8526	.4167						"	"	Homec.	Comm.	"
1965-6 'B'	.9515	.7647						Read.	Guid.	Opp.	Lib.	P.E.
1967-8 'B'	.8526	.4167						"	Opp.	Guid.	P.E.	Lib.

were city districts which revealed a different pattern between groupings based on size ('rho' = .72). In a comparison of the scaling pattern of organizational types, the only similarity discovered was between counties and divisions which had an identical order of item occurrence. The correlation of item order between this scale and that of the two scales for city districts yielded coefficients that were well below the criterion (.75 and .81).

On the basis of these findings it is possible to conclude that the ten specialisms are generally distributed according to a unidimensional pattern (Hypothesis I). While the same scale does not apply to all groupings of organizational type and size, there was a high degree of reliability over the four year period observed, among the scaling patterns discovered (Hypothesis II). The Scalograms for the five final scales are found in Appendix 'B', and the scales themselves are presented in Table 5 : 3.

TABLE 5 : 3

PRESENTATION OF FINAL SCALES

Grouping	C. of R.	C. of S.	Scale items in ascending order of occurrence 10	9	8	7	6	5	4	3	2	1
Counties & Divisions	.8859	.58	Read.	Voced.	Guid.	Opp.	Mus.	P.E.	Comm.	Lib.	Homec.	I.A.
City Dists. over 100	.9467	.8072	Read.	Opp.	Mus.	Guid.	Voced.	Lib.	I.A.	P.E.	Comm.	Homec.
City Dists. under 100	.8800	.4000	Read.	Guid.	Opp.	P.E.	Mus.	Comm.	Voced.	Lib.	I.A.	Homec.
Public &	'A'-.9000	.6623						Voced.	Mus.	Comm.	Homec.	I.A.
Sept. Dists.	'B'-.9000	.5789						Read.	Guid.	Opp.	Lib.	P.E.

B. DISCUSSION

It would appear then, that teaching specialization, as defined, constitutes a prominent dimension of the school systems of Alberta. The finding is one of considerable significance in terms of organizational theory in general and of educational organization in particular. On the basis of the high coefficients of reproducibility yielded, it is possible to assume that all of the requirements of unidimensionality were found to apply: internal consistency among the items, the absence of inhibition by single items, and the general representability of the area by a single variable. In addition, since the scales revealed high reliability over four years, there is every reason to believe that they may be applicable to future years as well--a finding with considerable practical implications. It is now necessary to postulate some reasons why first of all, such a unidimensional pattern was found and then why the same pattern was not found within every grouping.

Historical development may explain why the pattern of additions was found to be uniform in most cases, for the organizations observed. However, before one makes the facile correlation between the chronology of curriculum innovation and item order, it is necessary to make the important distinction between the historical and the statistical orders of abstraction. Although historical diversification may have been the basis for selecting the items for theoretical consistency, why there should be a pattern of additions at a point in time so long after the curriculum has been expanded is another question. The only possible connection between history and item popularity would be found in the argument that formal introduction of curriculum change at a provincial level is only the general or perhaps 'avant-garde' effect of myriad regional rates of organic growth. Such an argument would offer an interesting line of pursuit necessitating numerous case studies of the adaptation of individual systems to their regional environments.[1]

It may be, however, that the pattern of additions is predominantly the result of contextual effects such as size or organizational maturity and that a closer inspection of the pattern of errors would indicate the joint operation of two or more such variables. As Levy and Pugh have indicated, the Guttman scale as a 'first-step summary of the data' which 'has some analogy with the discovery of a strong first dimension in factor analysis' does not reveal the various contributions of underlying variables to the 'unidimensional core'. It would appear that size, urban location and number of sites are contributing factors to a system's addition of a specialism. However, the only possibility of exploring the effects of ordering scalogram rows by one of these variables rather than by 'scale type' is offered by multi-dimensional scaling techniques which at present 'await the statement of acceptable and explicit error theories and hence lack fully justifiable computing algorithms'.[2]

We turn now to the problem of why the same scale did not apply to all groupings. The ecological and historical background of both counties and divisions would explain why these large amalgamated rural units should be tractable by a similar scale, while cities and rural districts, each with its own unique context and structure, do not appear to have much in common with the other two groupings or with each other. Within the city grouping, it is not surprising, given the range of size, and organizational differences discussed earlier, that they should follow distinct scaling patterns.

The overall rank correlation of item order between the three ten-item scales are relatively low ('rho' = .75, .72, .81 resp.)--lower than might be expected among systems of the same province. The disparity can only be explained in terms of the unique historical and organizational factors operating at the district level--a finding which vindicates the initial caution in mixing observations of systems differing in formal control and size. It is interesting to note that the smaller city systems have higher similarity with counties and

divisions than do the large ones--presumably, though not necessarily, an effect of system size. Vocational education (10) has the greatest individual item variation, being more common in city than in rural districts. The reasons for the differential distribution of this and other items--notably physical education (5), opportunity classroom (1), commercial subjects (6)--lie in the background of organizational growth and differentiation. The explanation of the substantive variation of these scales is therefore a logical corollary to the search for the historical and contextual determinants of a particular pattern.

In the case of public and separate school districts, the fact that the five items which initially yielded high error in the ten-item scale also tended to yield the highest error among other groupings would indicate that the low mean size, rather than essentially different scale types, is the cause of there being two distinct dimensions in this grouping. The fact that this 'high error' scale includes items such as opportunity, guidance, library would indicate a logical consistency in this sub-universe based on a definition of 'services' rather than of 'curricula' and would suggest an investigation of the tendency towards bivariate scaling among the other groupings.

The ten teaching specialisms, industrial arts, home economics, opportunity, music, commercial, physical education, guidance, reading, library and vocational education were found to be scalable, not only for groupings of observations based on organizational type for the counties, school divisions and city districts of Alberta, but also for breakdowns within these categories based on organizational size and year of observation. Two five-item scales were discovered to apply to observations of public and separate districts generally, as well as to groupings over time. Hypothesis I, which postulates the internal consistency and unidimensionality of the item specialisms is therefore accepted.

The same scale was found to apply to all groupings of county and school divisions. For city districts unique scales were developed for each of the two groupings based on organizational size. The two scales developed for public and separate school districts were found to be stable over the four years observed. Hypothesis II, in as much as it postulates similarity of scaling pattern determined by rank order of item difficulty between the groupings of organizational type and size is therefore generally rejected. However, is as much as it postulates reliability of scaling pattern over the years observed, it is accepted.

FOOTNOES: CHAPTER V

1. That such a correlation between item popularity and chronological order of emergence does not necessarily hold has been demonstrated by Farrell, "Guttman Scales and Evolutionary Theory', Sociology of Education, XLII (June, 1969), 271-83. Farrell neglects however, to discriminate between diverse models of innovation and ascribes all structural differentiation to the effect of societal evolution.

2. Levy and Pugh, "Scaling and Multivariate Analyses in the Study of Organizational Variables", Sociology, III (May, 1969), 203.

CHAPTER VI

THE CORRELATES OF SPECIALIZATION--THE EFFECTS OF SIZE AND HISTORY

Now that it has been demonstrated that the ten specialisms chosen do in fact represent a single variable for the counties, cities, districts and school divisions of Alberta, it is possible to examine the second problem which is the applicability of different models of explanation, in this case the predictive effects of size (number of teachers) and of history (year of observation) on specialization scores.

Multiple regression was the statistical technique chosen to examine the relationship between size, history and specialization.[1] This technique makes it possible to estimate the improvement in prediction, expressed by a regression coefficient, achieved by adding a variable to a predictive model. The coefficients of two models, the 'unrestricted' and the 'restricted' are compared by means of an 'F-ratio' which expresses the probability, under a null hypothesis, of the added variable's significance in the predictive model. Since size was presumed, by theoretical deduction and by inspection to have at least some positive relationship with specialization scores, the added effect of history, that is of knowing the year of a particular observation, was investigated first.

The two most obvious indicators were system size at the time of observation and the year of observation itself. The former was to be measured by the number of teachers employed and the latter by a score of 1,2,3, or 4, corresponding to each of the four successive years observed, 1965-68. Growth effects as determined by the variation between size at each observation could therefore be controlled by these two measures. A complication arose however, from the fact

that any model for prediction between specialization scores and any other characteristics would have to incorporate a 'repeated measures' effect arising from the interdependence of observations of the same system.[2] A face value correlation that treated observations as separate systems may yield a spurious result since effects arising from the unique properties of a single system, its initial size for example, are magnified by multiple observations. To offset this, each system was given the status of an independent variable, thus allowing for the control of unique characteristics. Expressing all these effects in the form of the 'unrestricted' predictive model, we have

$$\hat{Y}_{it} = A + Bt + Cx_{it} + Di$$

In this model, 'A' is a constant value and 'B', 'C' and 'D' are variable weightings; 't' is the year of observation, 'i' represents individual system characteristics and 'x' the size of a system at a particular year of observation. '$\hat{Y}_{it}$' is the predictive criterion value--a specialization score at a particular observation. The 'restricted' model is derived by dropping 't' from the model, the effect we wish to estimate.

Using the multiple regression program (MULR05) held on disc for the Division of Educational Research Services, the Faculty of Education, University of Alberta, the predictive power of each model was observed. The data included only those 241 observations of systems found to be tractable by a single ten-point scale. The two models were then compared by means of the equation

$$F = \frac{(R_1^2 - R_2^2)/df_n}{(1-R_1^2)/df_n}$$

Where R_1^2 and R_2^2 are the squares of the product moment coefficients of correlation between predicted and actual scores yielded by the 'restricted' and 'unrestricted' models respectively.[3]

On the basis of the 'F-ratio' value thus derived it is possible to determine the probability, assuming the null hypothesis, of there being any significant improvement by adding 'history' to the predictive side of the equation. Expressing the foregoing in the more precise language of a hypothesis and a decision rule:

Hypothesis III : Among the observations of counties, city districts and divisions, there will be a significant improvement in prediction when 'history' as measured by a score for each of the four successive years observed, is included in a predictive model.

Decision Rule : If an 'F-ratio' value yielded from a comparison of two regression coefficients has a probability of occurrence of less than .01, then accept 'Hypothesis III'. If the probability of occurrence is equal to or greater than .01, then do not accept Hypothesis III.

The results of the analysis are:

'Unrestricted' model, R^2 = .88285

'Restricted' model R^2 = .84853

'F-ratio' = 47.75

P $\leq$ 0.001

'Hypothesis III' is therefore accepted.

From these results it is seen that the addition of 'year of observation' to the model does affect the power of prediction significantly. However, by comparing the actual difference between the unsquared regression coefficients--.96 as against .92--it is apparent that in real terms, the improvement is only slight. Were a longer period sampled it is probable that the difference would have been much more considerable.

Since the improvement achieved by adding 'year of observation' was so slight, in this sample at least, it was possible to reduce the number of terms in the model quite considerably. By ignoring this measure, one observation at random was chosen to represent each of the counties, divisions and cities sampled, thus eliminating the need to control for individual system effects. The model is therefore reduced to one of simple regression, expressed as

$$\hat{Y}_i = A + Bx_i$$

In this equation, 'A' is a constant, 'B' is a variable weighting; 'X_i' is the size of the individual system in the randomly sampled observations and '$\hat{Y}_i$' is the predicted criterion variable. Expressing the hypothesized relationship more exactly:

Hypothesis IV : Among the single observations randomly chosen for each system in the total sample, size will be found to be a significant predictor of specialization score.

Decision Rule : If the probability that r = 0 is less than .01, then accept 'Hypothesis IV'; if probability that r = 0 is equal to or greater than .01, then reject 'Hypothesis IV'.

Regression analysis yielded the following results:

R^2 = 0.36565

r = 0.6046

Constant= 2.262

Variable weighting = 0.0158

p(r = 0) $\leq$ 0.001

'Hypothesis IV' is therefore accepted.

From these results it is possible to construct the following regression equation for predicting specialization score from organizational size.

$$\hat{Y}_i = 2.262 + 0.016\ (x_i)$$

There are two important limitations of this equation, the one theoretical, the other statistical. The correlation between size and specialization, though apparently high represents only an initial 'zero-order' relationship that was felt intuitively to have over-riding theoretical significance. Although a deeper study may indeed vindicate this insight, without a much fuller multi-variate analysis of the effect of other contextual variables (such as age, resources, stability), the theoretical, as distinct from the statistical, connection between size and specialization must remain hypothetical. The equation has a statistical limitation in that it was based on observations of three uniquely scalable groupings. Although the bulk of the observations (191 out of 241) came from a single scale grouping (counties and divisions), two other groupings (city districts with over and under 100 teachers) each has a distinctive rank order of item occurrence. In order to predict from size to precise specialisms held, therefore, it would be necessary to develop an equation for each grouping tractable by an individual scale.

The strong relationship found between size and specialization is an indication, however inconclusive, of the theoretical affinity of the latter measure with the 'structuring of activities' dimension isolated in the Aston Studies, rather than with those of 'line control of workflow or 'concentration of authority', neither of which were found to have a significant relationship with size.[4] However, the incompleteness of the multivariate analysis of context, together with the ambiguity of the theoretical status of specialization

in personnel bureaucracies forewarns one from concluding that the same manifestations of 'structuring' that occur generally will also be found in school systems.

An investigation of two hypothesized correlates revealed that 'history' as measured by scores for year of observation over a four year period had a significant, though small effect on the prediction of specialization scores, while size, as measured by the number of teachers employed, was a powerful predictor.

FOOTNOTES: CHAPTER VI

1. George A. Ferguson, Statistical Analysis in Psychology and Education, 2nd ed. (New York: McGraw Hill, 1966), Chap. xxiv, pp. 388-402.

2. Daniel S.Lordahl, Modern Statistics for the Behavioral Sciences (New York: Ronald Press Co., 1967), pp.168-9.

3. R.A. Bottenberg and J. Ward, Applied Multiple Linear Regression. Technical Documentary Report PRL-TD3-63-6. Office of Technical Services, U.S. Department of Commerce, Washington, 1963.

4. D.S. Pugh et al., "The Context of Organizational Structures", Administrative Science Quarterly, XIV (March, 1969), 98.

CHAPTER VII

GENERAL CONCLUSION WITH SUGGESTED DIRECTIONS FOR FURTHER RESEARCH

It was found that teaching specialization in Alberta school systems, as measured by the endorsement of ten specialisms originating in the diversification of curricula and services, constitutes a strong and reliable dimension of organizational structure. Scores on this dimension were found to increase slightly though significantly over a four year period, independent of organizational growth, and to correlate quite significantly with organizational size.

Further work in the domain of the educational structure of school systems might use this study as a starting point either in the application of techniques similar to those used here for the isolation and measurement of other dimensions of structure--or in the exploration of the theoretical relationship of such inductively derived variables in a taxonomy of educational organization. These two approaches could be further elaborated: in the first instance, the measurement techniques themselves could be more intensively refined before being applied to other areas of structure; in the second, the example of the Aston studies has shown that a full understanding of an empirical taxonomy requires investigation of the contextual settings that condition structures.

It is not intended that the definition of specialization in schools used here be considered final, nor that the Guttman technique presents the only possibility for measuring the division of labor in an organization.[1] We have seen that the definition has excluded intra-area differentiation, and it is possible that a combination of both perspectives would yield a more satisfying model for the measurement of specialization. We have seen too, that the Guttman technique is inefficient in dealing with non-scale

types which, from a theoretical viewpoint, would be more amenable by multi-dimensional techniques. Intensive analytical study of the underlying factors of a unidimensional scale would permit the investigation of the contextual origins of the dominant variable and lead indirectly, to a theory of organizational growth.

Other areas of structure of educational organization--centralization of authority, formalization, standardization--await treatment by these and similar techniques. Followed by principal components analysis of organizational profiles so yielded, Corwin's proposal for an empirically-based taxonomy of educational organization could be realized. The utility of a taxonomy would be two-fold: first, in testing hypotheses as to the interrelationship of variables such as technology, power and the division of labor in school systems; secondly, in generating hypotheses as to the effect of structural properties of an organization on group and individual behavior.

Set in the fuller perspective of other properties of context and structure, this study may therefore be seen as an initial contribution to the development of a comprehensive, empirically-based taxonomy of educational organization. If, as has been suggested, "Sociology's main contribution to organizational theory is in its elucidation of structural problems"[2], it is possible too that such a taxonomy may in turn be instrumental in the development of a broader and more explicit conception of complex organization.

FOOTNOTES: CHAPTER VII

1. For another treatment of division of labor, see William A. Rushing and Vernon Davies, "Note on the Mathematical Formalization of a Measure of Division of Labor", Social Forces, XLIII (March, 1970), 394-96.

2. Paul Anisef et al., "A Review Article: Handbook of Organizations", Administrative Science Quarterly, XIII (September, 1968),323.

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APPENDIX 'A' SYSTEMS OBSERVED AND DATA DISPLAY

APPENDIX 'A'

SYSTEMS INCLUDED IN SAMPLE

I.D.	NAME	NO.	TYPE
01	St. Albert	3	S. Dist.
02	Banff	102	"
03	Brooks	2092	"
04	Stettler	1475	"
05	Canmore	168	"
06	St. Paul	2228	"
07	Bonnyville	2665	"
08	Hanna	2912	"
09	Devon	4972	"
10	Medicine Hat	21	City Dist.
11	Red Deer Sep.	17	"
12	Wetaskiwin Sep.	15	"
13	Camrose Sep.	60	"
14	Lethbridge Sep.	9	"
15	Calgary Sep.	1	"
16	Wetaskiwin	264	"
17	Lethbridge	51	"
18	Red Deer	104	"
19	Camrose	1315	"
20	Medicine Hat	76	"
21	Lamont	30	County
22	Flagstaff	29	"
23	Lac St. Anne	28	"
24	Minburn	27	"
25	Lethbridge	26	"
26	Leduc	25	"
27	Vermillion River	24	"
28	Red Deer	23	"
29	Two Hills	21	"
30	St. Paul	19	"
31	Paintearth	18	"
32	Wheatland	16	"
33	Lacombe	14	"
34	Smoky Lake	13	"
35	Athabasca	12	"
36	Forty Mile	8	"
37	Thorhild	7	"
38	Stettler	6	"
39	Warner	5	"
40	Newell	4	"
41	Vulcan	2	"
42	Crowsnest Pass	63	S. Div.
43	Drumheller Valley	43	"
44	Three Rivers	60	"
45	Fort Vermillion	52	"

I.D.	NAME	NO.	TYPE
46	Lac La Biche	51	S. Div.
47	Fairview	50	"
48	High Prairie	48	"
49	Calgary	41	"
50	Foothills	38	"
51	Westlock	37	"
52	Provost	33	"
53	Wainwright	32	"
54	Starland	30	"
55	Pincher Creek	29	"
56	Willow Creek	28	"
57	Stony Plain	23	"
58	Rocky Mountain	15	"
59	Peace River	10	"
60	Sullivan Lake	9	"
61	Berry Creek	1	"
62	Medicine Hat	4	"
63	Cardston	2	"
64	Glen Avon	5	S. Dist.
65	Pincher Creek	18	"
66	Thibault	35	"
67	Coleman	1216	"
68	East Smoky	54	S. Div.
69	Northland	61	"
70	Grand Prairie	1	County
71	Taber	6	S. Div.
72	Acadia	8	"
73	Neutral Hills	16	"
74	Lamont S.D.	18	"
75	Sturgeon	24	"
76	Macleod	28	S. Div.
77	Beaver	9	County
78	Wetaskiwin	10	"
79	Mountain View	17	"
80	Strathcona	20	"
81	Killam	22	S. Div.
82	Bonnyville	46	"
83	Spirit River	47	"
84	Camrose	22	County
85	Grand Prairie	2357	City Dist.
86	Drumheller	25	"
87	St. Albert Sep.	6	S. Dist.
88	Peace River	43	"
89	High River	144	"
90	Rocky Mountain	15	S. Div.

I.D.	NAME	NO.	TYPE
91	Biggin Hill	5029	S. Dist.
92	Ponoka County	3	County
93	Legal	1738	S. Dist.
94	Redcliffe	2283	"
95	Jasper	3063	"
96	St. Martin's	16	"
97	Taber	5	"
98	Forestburg Consol.	45	"
99	Crowsnest Consol.	78	"

TABLE 1-DATA DISPLAY-SYSTEMS OBSERVED BY I.D.

SPECIALISMS ID	YEAR	OPPOR	I.A.	HOMEC	MUS	P.F.	COMM	READ	LIBR	GUID	VOCED	TOTAL	NO.TEACH.
1	1965	*	*	*		*	*		*	*		7	54
1	1967	*	*	*					*	*		5	72
1	1968	*	*	*	*			*	*	*		7	79
2	1965		*	*		*	*					4	28
2	1966		*	*		*						3	28
2	1967		*	*			*		*			4	29
2	1968		*	*		*	*		*			5	21
3	1965					*	*		*			3	53
3	1966					*	*		*			3	56
3	1968					*			*	*		3	67
4	1965		*	*		*	*				*	5	62
4	1966		*		*	*	*		*		*	6	63
4	1968		*	*	*	*	*		*	*	*	8	76
5	1965		*	*					*			3	25
5	1966											0	24
5	1968		*	*		*						3	26
6	1965	*				*	*		*	*		5	60
6	1966					*			*	*		3	64
6	1968	*	*	*		*	*	*	*	*		8	67
7	1965		*	*		*			*			4	39
7	1966	*	*	*		*			*			5	46
7	1968	*	*	*		*	*		*	*		7	51
8	1965	*	*	*		*			*			5	41
8	1966	*	*	*	*	*	*		*			7	47
8	1967	*	*	*	*	*	*		*			7	46
8	1968	*	*	*	*	*	*		*			7	47
9	1965					*			*			2	24
9	1968					*	*		*			3	27
10	1965		*	*		*	*		*			5	61
10	1966		*	*		*	*		*			5	66
10	1967			*		*	*		*			4	76
10	1968		*	*		*	*		*			5	82
11	1965		*	*		*			*			4	46
11	1966		*	*		*	*					4	48
11	1967		*	*		*	*		*			5	48

TABLE 1-DATA DISPLAY-SYSTEMS OBSERVED BY I.D. CONTINUED

SPECIALISMS ID	YEAR	OPPOR	I.A.	HOMEC	MUS	P.E.	COMM	READ	LIBR	GUID	VOCED	TOTAL	NO.TEACH.
11	1968		*	*		*				*		4	53
12	1965											0	9
12	1966											0	10
12	1967											0	10
12	1968											0	11
13	1965			*			*					2	24
13	1966											0	19
13	1967								*			1	22
13	1968											0	21
14	1965		*	*	*							3	185
14	1966		*	*			*		*	*		5	88
14	1967		*	*	*	*	*		*	*		7	96
14	1968	*	*	*	*	*	*		*	*		8	100
15	1965		*	*	*				*		*	5	545
15	1966	*	*	*	*				*		*	6	615
15	1967	*	*	*	*		*			*		6	747
15	1968	*	*	*	*	*	*	*	*	*	*	10	801
16	1965		*	*		*	*		*		*	6	68
16	1966		*	*		*	*		*		*	6	72
16	1967		*	*	*	*	*		*		*	7	75
16	1968	*	*	*	*	*	*		*	*	*	9	78
17	1965	*	*	*	*	*	*		*		*	8	302
17	1966	*	*	*		*	*		*		*	7	308
17	1967	*	*	*	*	*	*		*	*	*	9	260
17	1968	*	*	*	*	*	*		*	*	*	9	78
18	1965	*	*	*		*	*		*	*	*	8	237
18	1966		*	*	*	*	*		*	*	*	8	265
18	1967		*	*	*	*	*		*	*	*	8	289
18	1968	*	*	*	*	*	*		*	*	*	9	296
19	1965		*	*		*	*			*	*	6	67
19	1966		*	*		*	*		*	*	*	7	78
19	1967		*	*		*	*		*	*	*	7	87

TABLE 1-DATA DISPLAY-SYSTEMS OBSERVED BY I.D. CONTINUED CONTINUED

SPECIALISMS ID	YEAR	OPPOR	I.A.	HOMEC	MUS	P.E.	COMM READ	LIBR	GUID	VOCED	TOTAL	NO. TEACH.
19	1968		*	*		*	*	*	*	*	7	85
20	1965		*	*	*	*	*	*		*	7	241
20	1966		*	*	*	*	*	*		*	7	254
20	1968	*	*	*		*	*	*	*	*	8	128
21	1968		*	*				*			3	95
22	1968	*	*		*	*	*	*	*		7	136
23	1965										0	129
23	1966		*	*	*			*			4	139
23	1967	*	*	*	*		*	*	*		7	154
23	1968	*	*	*	*	*	*	*			7	166
24	1965		*	*	*	*	*				5	108
24	1966	*	*	*	*	*	*	*	*	*	9	120
24	1967	*	*	*	*	*	*	*		*	8	126
24	1968	*	*	*	*	*	*	*	*	*	9	128
25	1965		*	*							2	149
25	1966		*	*				*			3	153
25	1967		*	*		*		*		*	5	155
25	1968		*	*		*	*	*	*		6	155
26	1965		*	*	*	*	*	*			6	201
26	1966		*	*	*	*	*	*		*	7	202
26	1967		*	*	*	*	*				5	208
26	1968	*	*	*	*	*	*	*			7	224
27	1965		*	*		*	*	*			5	115
27	1966		*	*		*	*	*			5	122
27	1967		*	*		*	*	*			5	127
27	1968	*	*	*		*	*	*	*		7	26
28	1965	*	*	*	*	*	*	*			7	207
28	1968	*	*	*	*	*	*	*	*		8	236
29	1965		*	*							2	85

TABLE 1-DATA DISPLAY-SYSTEMS OBSERVED BY I.D. CONTINUED CONTINUED

SPECIALISMS ID	YEAR	OPPOR	I.A.	HOMEC	MUS	P.E.	COMM	READ	LIBR	GUID	VOCED	TOTAL NO.	TEACH.
29	1966		*	*	*							3	85
29	1967		*	*								2	87
29	1968		*	*				*				3	90
30	1965		*	*								2	82
30	1966		*	*								2	89
30	1967		*	*								2	91
30	1968		*	*								2	91
31	1965		*	*								2	59
31	1966		*	*				*				3	61
31	1967		*	*		*		*				4	64
31	1968		*	*	*	*	*	*				6	64
32	1965		*									1	91
32	1966		*	*					*			3	94
32	1967		*	*					*			3	101
32	1968	*	*	*		*	*	*				6	98
33	1965		*	*	*	*	*	*				6	182
33	1966		*	*	*	*	*	*			*	7	173
33	1967		*	*	*	*	*	*	*		*	8	190
33	1968	*	*	*	*	*	*	*	*		*	9	195
34	1965		*	*								2	72
34	1966		*	*		*	*					4	73
34	1967	*	*	*	*	*	*					6	78
34	1968		*	*				*				3	76
35	1966		*	*	*	*	*	*				6	125
35	1968	*	*	*	*	*	*	*	*			8	129
36	1965		*	*			*					3	72

TABLE 1-DATA DISPLAY-SYSTEMS OBSERVED BY I.D. CONTINUED CONTINUED

SPECIALISMS ID	YEAR	OPPOR	I.A.	HOMEC	MUS	P.E.	COMM	READ	LIBR	GUID	VOCED	TOTAL	NO. TEACH.
36	1966		*	*			*		*			4	76
36	1968		*	*	*		*	*				5	82
37	1965		*	*								2	79
37	1966											0	76
37	1967									*		1	81
37	1968								*	*		2	82
38	1965		*	*								2	66
38	1966		*									1	66
38	1967		*	*								2	66
38	1968											0	64
39	1965		*	*	*	*	*		*			6	109
39	1966		*	*	*	*	*		*			6	110
39	1967		*	*	*	*	*		*			6	109
39	1968		*	*	*	*	*		*			6	111
40	1965		*	*								2	92
40	1966		*	*								2	84
40	1967		*	*								2	90
40	1968	*	*									2	93
41	1965		*	*	*	*	*		*	*		7	99
41	1966	*	*	*		*	*			*		6	100
41	1967	*	*	*	*	*	*					6	100
41	1968	*	*	*	*	*	*		*	*		8	30
42	1967		*	*		*			*	*		5	75
42	1968	*	*	*	*	*						5	80
43	1965		*	*		*	*				*	5	67

TABLE 1-DATA DISPLAY-SYSTEMS OBSERVED BY I.D. CONTINUED CONTINUED

SPECIALISMS ID	YEAR	OPPOR	I.A.	HOMEC	MUS	P.E.	COMM	READ	LIBR	GUID	VOCED	TOTAL	NO.TEACH.
43	1966		*	*			*				*	4	79
43	1967		*	*		*						3	78
43	1968	*	*	*		*	*			*	*	7	84
44	1965											0	104
44	1966											0	102
44	1967				*				*			2	107
44	1968				*			*				2	110
45	1967		*	*					*			3	72
45	1968		*	*	*	*	*		*			6	76
46	1965		*	*	*	*	*					5	90
46	1966	*	*	*	*	*			*			6	92
46	1967	*	*	*	*	*			*			6	100
46	1968	*	*	*	*	*	*		*	*		8	101
47	1965											0	67
47	1966											0	69
47	1967											0	67
47	1968	*										1	77
48	1965		*	*		*	*					4	143
48	1966	*	*	*					*	*		5	148
48	1967		*	*			*		*			4	145
48	1968	*	*	*		*	*		*	*		7	156
49	1965				*	*						2	109
49	1966		*	*					*			3	134
49	1967		*	*					*			3	145
49	1968	*	*	*			*		*			5	129

TABLE 1-DATA DISPLAY-SYSTEMS OBSERVED BY I.D. CONTINUED CONTINUED

SPECIALISMS ID	YEAR	OPPOR	I.A.	HOMEC	MUS	P.E.	COMM	READ	LIBR	GUID	VOCED	TOTAL	NO.TEACH.
50	1965					*	*		*			3	101
50	1966					*	*		*			3	98
50	1967	*				*	*		*			4	107
50	1968	*			*	*	*		*	*		6	152
51	1965		*	*	*	*	*		*			6	131
51	1966		*	*	*	*	*		*			6	129
51	1967		*	*	*	*	*		*			6	129
51	1968		*	*	*	*	*		*			6	126
52	1966		*									1	50
52	1967			*								1	49
52	1968											0	53
53	1965		*	*	*	*	*		*			6	97
53	1966		*	*	*	*	*		*	*		7	102
53	1968	*	*	*	*	*	*		*			7	109
54	1965											0	39
54	1968											0	40
55	1965		*	*		*	*		*			5	69
55	1966		*	*		*	*		*			5	71
55	1967		*	*	*	*	*		*			6	78
55	1968	*	*	*	*	*	*		*	*		8	81
56	1966		*	*	*	*	*		*			6	135
56	1967		*	*	*		*		*	*		6	135
56	1968		*	*	*		*	*	*	*		7	152
57	1965	*	*	*		*	*		*			6	170
57	1966	*	*	*			*		*			5	175

TABLE 1-DATA DISPLAY-SYSTEMS OBSERVED BY I.D. CONTINJED CONTINUED

SPECIALISMS ID	YEAR	OPPOR	I.A.	HOMEC	MUS	P.E.	COMM	READ	LIBR	GUID	VOCED	TOTAL	NO.TEACH.
57	1967	*	*	*			*	*				5	179
57	1968	*	*	*	*	*	*	*				7	192
58	1967		*	*		*	*	*				5	116
58	1968		*	*		*	*	*				5	114
59	1965			*			*					2	135
59	1966		*	*			*	*				4	145
59	1967	*	*	*			*	*				5	150
59	1968	*	*			*	*	*				5	167
60	1967											0	18
60	1968							*		*		2	18
61	1965											0	12
61	1968	*	*									2	14
62	1965		*	*								2	55
62	1966			*				*				2	53
62	1967							*				1	55
62	1968					*		*				2	57
63	1965		*	*	*	*	*					5	120
63	1966		*	*	*	*	*	*				6	122
63	1967		*	*	*	*	*					5	120
63	1968		*	*	*	*	*	*				6	126
64	1965		*	*	*		*					4	21
64	1967	*	*		*	*	*	*				6	26
64	1968							*				1	26
65	1965		*									1	19
65	1967		*					*				2	24

TABLE 1-DATA DISPLAY-SYSTEMS OBSERVED BY I.D. CONTINUED CONTINUED

SPECIALISMS ID	YEAR	OPPOR	I.A.	HOMEC	MUS	P.E.	COMM	READ	LIBR	GUID	VOCED	TOTAL	NO.TEACH.
65	1968		*	*	*	*	*		*			6	25
66	1965											0	22
67	1965		*	*		*						3	31
68	1965		*	*		*	*	*	*	*		7	58
68	1967		*	*								2	73
69	1965		*	*	*		*				*	5	147
69	1966		*	*			*		*	*	*	6	150
69	1967	*	*	*			*				*	5	172
70	1965	*	*	*	*	*			*	*		7	134
70	1966	*	*			*	*		*	*		6	136
70	1967	*	*	*			*		*	*		6	145
71	1965		*	*	*	*	*		*	*		7	134
71	1966		*	*	*	*	*		*			6	140
71	1967		*	*	*	*	*		*	*		7	152
72	1965		*	*								2	54
72	1966		*	*								2	52
72	1967											0	52
73	1965											0	33
73	1966											0	38
73	1967				*							1	41
74	1965		*	*					*			3	102
74	1966		*	*					*			3	102
74	1967		*	*					*			3	96
75	1965											0	126
75	1966											0	95

TABLE 1-DATA DISPLAY-SYSTEMS OBSERVED BY I.D. CONTINUED CONTINUED

SPECIALISMS ID	YEAR	OPPOR	I.A.	HOMEC	MUS	P.E.	COMM	READ	LIBR	GUID	VOCED	TOTAL	NO.TEACH.
76	1965		*	*	*	*	*	*				6	132
77	1965		*	*		*	*	*				5	116
77	1966		*	*		*	*	*				5	123
77	1967		*	*		*	*	*				5	120
78	1965		*	*			*	*				4	115
78	1966		*	*			*	*	*			5	125
78	1967	*	*	*			*	*				5	121
79	1965		*	*			*	*				4	182
79	1966	*	*	*		*	*	*				6	177
80	1965	*	*	*	*	*	*	*				7	241
81	1965		*				*	*				3	116
81	1966		*	*		*	*					4	112
82	1965	*	*	*		*						4	116
82	1966	*	*	*		*	*					5	121
82	1967	*	*	*		*		*				5	124
83	1965	*			*							2	89
83	1966	*										1	91
84	1965		*	*								2	131
84	1966		*	*								2	128
84	1967		*	*								2	126
85	1965		*	*	*	*	*	*	*		*	8	113
85	1966		*	*	*	*	*	*			*	7	123
85	1967	*	*	*	*	*	*	*			*	8	135
86	1965											0	13
86	1966											0	13

TABLE 1-DATA DISPLAY-SYSTEMS OBSERVED BY I.D. CONTINUED CONTINUED

SPECIALISMS ID	YEAR	OPPOR	I.A.	HOMEC	MUS	P.E.	COMM READ	LIBR	GUID	VOCED	TOTAL NO.	TEACH.
86	1967										0	11
87	1965		*	*		*	*				4	77
87	1966		*	*	*	*	*	*			6	98
87	1967			*		*	*	*	*		5	108
88	1965										0	15
89	1965					*	*				2	29
89	1966					*	*				2	29
89	1967						*	*			2	33
90	1966		*	*		*	*	*			5	108
91	1966		*								1	60
92	1966	*	*	*	*	*	*	*	*	*	9	182
92	1967	*	*	*	*	*	*	*	*	*	9	190
93	1966										0	22
94	1966							*			1	20
95	1966			*		*	*				3	30
95	1967		*	*		*	*				4	30
96	1966										0	19
97	1966		*	*				*			3	23
98	1966		*	*			*				3	18
99	1965		*	*		*					3	43
99	1966		*	*		*					3	48

APPENDIX 'B' - SCALOGRAM ANALYSES OF FINAL SCALES

EXPLANATION OF SCALOGRAM MATRIX

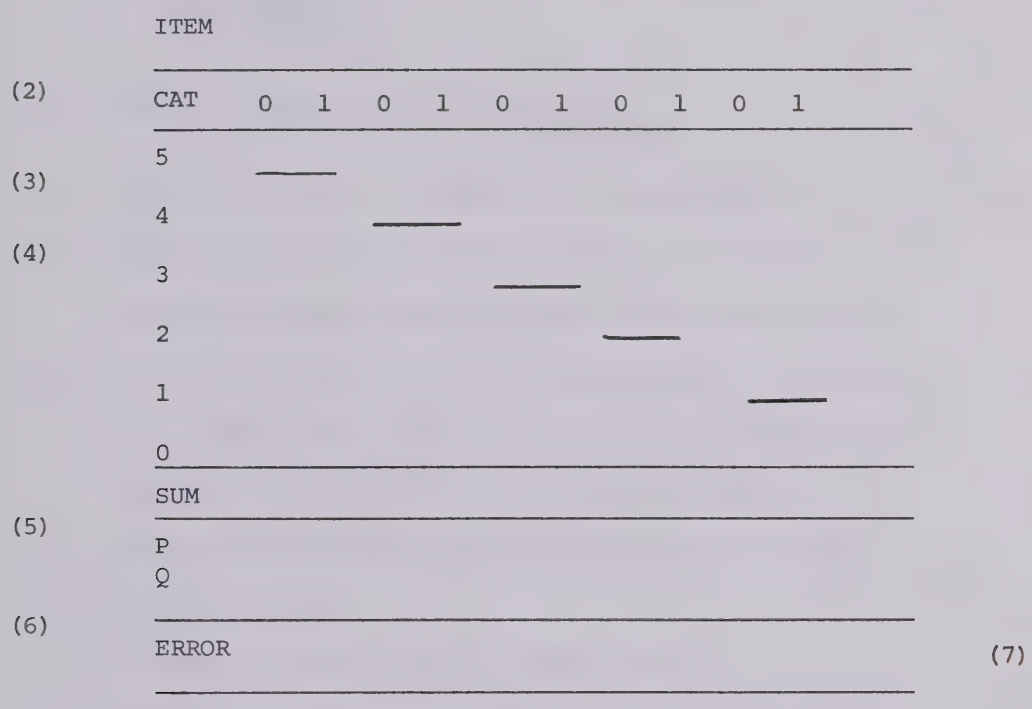
TITLE:

NO. OF CASES =

NO. OF CASES LESS NONRESPONSE =

THERE ARE X ITEMS IN THIS MATRIX NUMBERED (1)

SCALE-TYPE MATRIX FOR GUTTMAN SCALING USING THE GOODENOUGH TECHNIQUE



(8) COEFFICIENT OF REPRODUCIBILITY =

(9) MINIMUM MARGINAL REPRODUCIBILITY =

(10) PERCENT IMPROVEMENT =

(11) COEFFICIENT OF SCALABILITY =

(1) Items are listed in ascending order of occurrence.

CODE: 1. Opportunity classromm
2. Industrial Arts
3. Home Economics
4. Music
5. Physical Education
6. Commercial
7. Reading
8. Library
9. Guidance
10. Vocational

(2) Response Categories: 1 = possession
0 = non-possession

(3) Rows are ordered by 'scale type' or groupings of individuals with the same total score. Each row displays the distribution of items within each 'type'.

(4) Horizontal lines indicate 'cutting points', above which, in a perfect scale, there will be no cases that do not possess the item and below which no cases that do.

(5) 'P' indicates the percentage of the sample that does possess the item;

'Q' indicates the percentage that does not.

(6) Errors are computed for each category within each item column by adding the number of discrepancies from perfect pattern indicated by 'cutting points'.

(7) Total number of errors.

(8) The Coefficient of Reproducibility (CR)

$$= 1 - \frac{\text{Total no. errors}}{\text{No. cases x No. items}}$$

(9) The Minimum Marginal Reproducibility (MMR) is the coefficient derived when the modal score for each item (i.e. '1' or '0') is used to reproduce score patterns.

(10) The Percent Improvement (PI) = CR - MMR

(11) The Coefficient of Scalability

$$= \frac{PI}{1 - MMR}$$

This is a check on spuriously high CR's resulting from high modal or marginal reproducibility.

Nie, Bent and Hull: Ref: Statistical Package for the Social Sciences, 1968.

APPENDIX 'B'- SCALE#1-DIVISIONS AND COUNTIES

NO. OF CASES = 191
NO. OF CASES LESS NONRESPONSE = 191

THERE ARE 10 ITEMS IN THIS MATRIX. ITEMS NUMBERED 7 10 9 1 4 5 6 8 3 2

SCALE-TYPE MATRIX FOR GUTTMAN SCALING USING THE GOODENOUGH TECHNIQUE

ITEM	7		10		9		1		4		5		6		8		3		2		
CAT	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	
S 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	5	0	0	5	0	5	0	5	0	5	0	5	0	5	0	5	0	5	0	5	5
8	7	0	5	2	1	6	1	6	0	7	0	7	0	7	0	7	0	7	0	7	7
7	18	2	17	3	8	12	8	12	4	16	2	18	1	19	1	19	1	19	0	20	20
6	34	0	33	1	27	7	23	11	8	26	3	31	2	32	3	31	2	32	1	33	34
5	32	1	29	4	30	3	22	11	25	8	10	23	5	28	11	22	1	32	0	33	33
4	13	0	12	1	13	0	11	2	12	1	7	6	3	10	5	8	1	12	1	12	13
3	19	0	19	0	17	2	19	0	18	1	16	3	15	4	5	14	3	16	2	17	19
2	31	1	32	0	30	2	29	3	28	4	30	2	31	1	27	5	9	23	9	23	32
1	10	0	10	0	9	1	8	2	9	1	10	0	10	0	9	1	9	1	6	4	10
0	18	0	18	0	18	0	18	0	18	0	18	0	18	0	18	0	18	0	18	0	18
SUM	187	4	175	16	153	38	139	52	122	69	96	95	85	106	79	112	44	147	37	154	191
P	0.02		0.08		0.20		0.27		0.36		0.50		0.55		0.59		0.77		0.81		
Q	1	0.98		0.92		0.80		0.73		0.64		0.50		0.45		0.41		0.23		0.19	
ERROR	0	4	0	11	1	27	9	29	12	15	15	11	11	5	25	6	17	1	19	0	218

COEFFICIENT OF REPRODUCIBILITY = 0.8859 (See pp.89-91)

MINIMUM MARGINAL REPRODUCIBILITY = 0.7283

PERCENT IMPROVEMENT = 0.1576
COEFFICIENT OF SCALABILITY = 0.5800

APPENDIX 'B'- SCALE#2-CITY DISTRICTS WITH OVER 100 TEACHERS

NO. OF CASES = 30
NO. OF CASES LESS NONRESPONSE = 30

THERE ARE 10 ITEMS IN THIS MATRIX. ITEMS NUMBERED 7 1 4 9 10 8 2 5 6 3

SCALE-TYPE MATRIX FOR GUTTMAN SCALING USING THE GOODENOUGH TECHNIQUE

ITEM	7		1		4		9		10		8		2		5		6		3		
CAT	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	
S 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9	2	0	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	2
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	5	0	5	0	3	2	1	4	1	4	0	5	0	5	0	5	0	5	0	5	5
6	3	0	3	0	3	0	2	1	0	3	1	2	0	3	0	3	0	3	0	3	3
5	5	0	5	0	5	0	4	1	5	0	0	5	0	5	1	4	0	5	0	5	5
4	4	0	4	0	4	0	3	1	4	0	2	2	1	3	0	4	2	2	0	4	4
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	0	1	0	1	1
1	1	0	1	0	1	0	1	0	1	0	0	1	1	0	1	0	1	0	1	0	1
0	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9	0	9
SUM	30	0	28	2	26	4	21	9	21	9	13	17	12	18	12	18	12	18	10	20	30
P	0.0		0.07		0.13		0.30		0.30		0.57		0.60		0.60		0.60		0.67		
Q	1.00		0.93		0.87		0.70		0.70		0.43		0.40		0.40		0.40		0.33		
ERROR	0	0	0	0	0	2	1	3	1	0	1	3	1	0	1	0	2	0	1	0	16

COEFFICIENT OF REPRODUCIBILITY = 0.9467

MINIMUM MARGINAL REPRODUCIBILITY = 0.7233

PERCENT IMPROVEMENT = 0.2233
COEFFICIENT OF SCALABILITY = 0.8072

(See pp.89-91)

APPENDIX"B"- SCALE#3-CITY DISTRICTS WITH UNDER 100 TEACHERS

NO. OF CASES = 20
NO. OF CASES LESS NONRESPONSE = 20

THERE ARE 10 ITEMS IN THIS MATRIX. ITEMS NUMBERED 7 9 1 5 4 6 10 8 2 3

SCALE-TYPE MATRIX FOR GUTTMAN SCALING USING THE GOODENOUGH TECHNIQUE

ITEM	7		9		1		5		4		6		10		8		2		3		
CAT	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	
S 10	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	1
9	2	0	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	0	2	2
8	8	0	2	6	3	5	0	8	2	6	0	8	1	7	0	8	0	8	0	8	8
7	4	0	4	0	3	1	0	4	1	3	0	4	0	4	0	4	0	4	0	4	4
6	2	0	1	1	0	2	2	0	0	2	1	1	1	1	1	1	0	2	0	2	2
5	1	0	1	0	1	0	1	0	0	1	1	0	0	1	0	1	0	1	0	1	1
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	1	0	1	0	1	0	1	0	0	1	1	0	1	0	1	0	0	1	0	1	1
2	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	0	1	0	1	1
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SUM	19	11	10	10	9	11	5	15	4	16	4	16	4	16	3	17	0	20	0	20	20
P	0.05		0.50		0.55		0.75		0.80		0.80		0.80		0.85		1.00		1.00		
Q		0.95		0.50		0.45		0.25		0.20		0.20		0.20		0.15		0.0		0.0	
ERROR	0	0	0	7	3	3	0	0	3	2	2	0	2	0	2	0	0	0	0	0	24

COEFFICIENT OF REPRODUCIBILITY = 0.8800

(See pp.89-91)

MINIMUM MARGINAL REPRODUCIBILITY = 0.8000

PERCENT IMPROVEMENT = 0.0800

COEFFICIENT OF SCALABILITY = 0.4000

APPENDIX 'B'- SCALE#4(A)-PUBLIC AND SEPARATE DISTRICTS

NO. OF CASES = 52
NO. OF CASES LESS NONRESPONSE = 52

THERE ARE 5 ITEMS IN THIS MATRIX. ITEMS NUMBERED 10 4 6 3 2

SCALE-TYPE MATRIX FOR GUTTMAN SCALING USING THE GOODENOUGH TECHNIQUE

ITEM	10		4		6		3		2		
CAT	0	1	0	1	0	1	0	1	0	1	
S 5	0	1	0	1	0	1	0	1	0	1	1
4	6	2	1	7	0	8	1	7	0	8	8
3	11	0	9	2	1	10	1	10	0	11	11
2	13	0	13	0	11	2	0	13	2	11	13
1	9	0	9	0	2	7	9	0	7	2	9
0	10	0	10	0	10	0	10	0	10	0	10
SUM	49	3	42	10	24	28	21	31	19	33	52
P	0.06		0.19		0.54		0.60		0.63		
Q	0.94		0.81		0.46		0.40		0.37		
ERROR	0	2	1	2	1	9	2	0	9	0	26

COEFFICIENT OF REPRODUCIBILITY = 0.9000

MINIMUM MARGINAL REPRODUCIBILITY = 0.7038 (See pp.89-91)

PERCENT IMPROVEMENT = 0.1962
COEFFICIENT OF SCALABILITY = 0.6623

APPENDIX'B'-SCALE#4(B)- PUBLIC AND SEPARATE DISTRICTS

NO. OF CASES = 52
NO. OF CASES LESS NONRESPONSE = 52

THERE ARE 5 ITEMS IN THIS MATRIX. ITEMS NUMBERED 7 9 1 8 5

SCALE-TYPE MATRIX FOR GUTTMAN SCALING USING THE GOODENOUGH TECHNIQUE

ITEM	7		9		1		8		5		
CAT	0	1	0	1	0	1	0	1	0	1	
S 5	0	1	0	1	0	1	0	1	0	1	1
4	3	1	0	4	0	4	0	4	1	3	4
3	11	0	6	5	4	7	0	11	1	10	11
2	5	0	9	0	9	0	0	9	0	9	9
1	19	0	19	0	19	0	12	7	7	12	19
0	8	0	8	0	8	0	8	0	8	0	8
SUM	50	2	42	10	40	12	20	32	17	35	52
P	0.04		0.19		0.23		0.62		0.67		
Q	0.96		0.81		0.77		0.38		0.33		
ERROR	0	1	0	5	4	0	0	7	9	0	26

COEFFICIENT OF REPRODUCIBILITY = 0.9000

MINIMUM MARGINAL REPRODUCIBILITY = 0.7654 (See pp.89-91)

PERCENT IMPROVEMENT = 0.1346
COEFFICIENT OF SCALABILITY = 0.5738

APPENDIX 'C' - SECRETARY-TREASURER'S REPORT, p. 12

ALL SCHOOL-BASED PERSONNEL

(As of October 31, 1969)

Designation of Staff	Number According to Annual Salary Including Allowances																			
	Under $4,500	4,500 - 4,999	5,000 - 5,499	5,500 - 5,999	6,000 - 6,499	6,500 - 6,999	7,000 - 7,499	7,500 - 7,999	8,000 - 8,499	8,500 - 8,999	9,000 - 9,499	9,500 - 9,999	10,000 - 10,499	11,000 - 11,499	11,500 - 11,999	12,000 - 12,999	13,000 - 13,999	14,000 - 14,999	15,000 - 15,999	Over 16,000	TOTALS
DESIGNATIONS REQUIRING TEACHING CERTIFICATES																					
Principal																					
Vice-principal																					
Reg. Classroom																					
Opp. Classroom																					
Ind. Arts																					
Home Economics																					
Music																					
Phys. Ed.																					
Commercial																					
French Lang.																					
Reading																					
Library																					
Guidance																					
Vocational																					
Relieving																					
Dept. Head																					